Proposed
Total Maximum Daily Load Development For the Ochlockonee and St. Marks River Basins, Florida

Nutrients, DO, BOD, Fecal Coliform, Total Coliform, Turbidity, and TSS

September 30, 2003

Region4 serving the southeast

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SUMMARY SHEET

Total Maximum Daily Load (TMDL) Development for the

Ochlockonee and St. Marks River Basins

Table 1 303(d) Listed Waterbody Information

State	Florida
County	Jefferson and Leon Counties
Major River Basin	Ochlockonee and St. Marks River Basins
Watershed	03120001, 03120003
Constituent(s) Causing Impairments	Nutrients (TN and TP), Dissolved Oxygen, BOD, Fecal Coliform, Total Coliform, Turbidity, and TSS
Designated Uses	Class III

TMDL Development

- **Analysis/Modeling**:

Data were collected from the Impaired Water Rule (IWR) Run 11 and from the City of Tallahassee Stormwater Utilities Department. These data were used to assess each of the impaired waterbodies for each of the listed parameters.

A loading curve approach was used to develop the fecal coliform TMDL for Ward Creek. This approach is used when there are ample data to develop a flow duration curve and fecal coliform data to develop fecal loads. The loading curve is extremely useful in determining if wet versus dry weather sources.

To develop a translation from the narrative nutrient criterion, a reference stream approach was performed using ecoregion reference stream data collected by FDEP. There were 11 stations obtained from an environmental specialist at FDEP and nine were determined to have adequate nutrient data available. Using EPA protocol for developing nutrient targets in rivers and streams (EPA, 2001), the 75^{th} percentile of the reference data were computed for TN and TP targets as 720 and 77 µg/L, respectively.

Critical Conditions/Seasonal Variation:

The TMDLs expressed in this report represent a combination of wet and dry weather loadings. The fecal loading curve is a good example of examining the data under a series of flow conditions. The fecal coliform TMDL expresses coliform counts as an average count per day. The average allowable count considers a range of flow conditions excluding extreme dry and wet weather events.

Table 2 Ward Creek (459) TMDL Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (Stormwater) % Reduction	LA % Reduction
TN (mg/L)	0.39	0.72	0%	0%
TP (mg/L)	0.09	0.08	18%	18%
BOD5 (mg/L)	0.83	2.00	0%	0%
Fecal Coliform (counts/day)	7.06E+10	4.00E+10	43%	43%
Total Coliform (#/100mL)	2,500	2,400	4%	4%

Table 3 Harbinwood Estates (746) TMDL Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (Stormwater) % Reduction	% Reduction
TN (mg/L)	0.70	0.72	0%	0%
TP (mg/L)	0.21	0.08	64%	64%
BOD5 (mg/L)	0.54	2.00	0%	0%

Table 4. Northeast Drainage Ditch (756) TMDL Load Allocation Summary

Stream and Station	Parameter	WLA		LA	TMDL[1] (counts/day)	Percent Reduction[2]
		Wastewater	Stormwater			
NED S695	Fecal	0	92% reduction[2]	1.17E12	1.17E12	92
NEW S695	Total	0	78% reduction[2]	3.52E12	3.52E12	78

[1] The TMDL represents the average allowable load between the 10^{th} and 90^{th} percent recurrence interval.

[2] The overall percent reduction needed to achieve the in-stream water quality criteria of 400 counts/100mL for Fecal Coliform, or 2400 counts/100mL for Total Coliform.

Table 5 Godby Ditch (820) TMDL Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (Stormwater) % Reduction	% Reduction
TN (mg/L)	0.36	0.72	0%	0%
TP (mg/L)	0.15	0.08	50%	50%
BOD5 (mg/L)	1.86	2.00	0%	0%
Turbidity (NTU)	9.6	29	0%	0%

Table 6 Central Drainage Ditch (857) TMDL Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (Stormwater) % Reduction	% Reduction
TN (mg/L)	0.70	0.72	0%	0%
TP (mg/L)	0.12	0.08	37%	37%
Fecal Coliform (#/100mL)	730	400	45%	45%
Total Coliform (#/100mL)	22,867	2,400	90%	90%
Turbidity (NTU)	5.95	29	0%	0%

Table 7 St. Augustine Branch (865) Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (Stormwater) % Reduction	% Reduction
TN (mg/L)	0.51	0.72	0%	0%
TP (mg/L)	0.11	0.08	29%	29%
Fecal Coliform (#/100mL)	760	400	47%	47%
Total Coliform (#/100mL)	16000	2400	85%	85%
Turbidity (NTU)	1.6	29	0%	0%

Table 8 East Drainage Ditch (916) Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (Stormwater) % Reduction	% Reduction
TN (mg/L)	0.55	0.72	0%	0%
TP (mg/L)	0.13	0.08	37%	37%
BOD5 (mg/L)	0.52	2.00	0%	0%
Fecal Coliform (#/100mL)	3,400	400	88%	88%
Total Coliform (#/100mL)	11,000	2,400	78%	78%
Turbidity (NTU)	29.91	29	3%	3%

- Public Notice Date: September 30,2003
- Endangered Species (yes or blank):
- EPA Lead on TMDL (EPA or blank): EPA
- TMDL Considers Point Source, Nonpoint Source, or Both: Both

1. Introduction

The Clean Water Act (CWA) [40 CFR Part 130] requires each State to identify waters within its boundaries not meeting water quality standards applicable to the water's designated uses. This list of identified waters (referred to as the 303(d) list) must be submitted to the U.S. Environmental Protection Agency (EPA) for review and approval. The "listed" waters identified by the State are prioritized for Total Maximum Daily Loads (TMDL) development based on factors described in CWA regulations, such as the use of the water and the severity of pollution. A separate TMDL is established for each pollutant at a level necessary to attain the applicable water quality standards taking into account seasonal variations and a margin of safety. The TMDL establishes allowable loadings of pollutants for a water body based on the relationship between pollution sources and in-stream water quality conditions. With this information, states can establish water-quality based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Florida Department of Environmental Protection (FDEP) developed a statewide, watershed-based approach to water resource management. Under the watershed management approach, water resources are managed on the basis of natural boundaries, such as river basins, rather than political boundaries. The watershed management approach is the framework DEP uses for implementing TMDLs. The state's 52 basins are divided into 5 groups. Water quality is assessed in each group on a rotating five-year cycle. Portions of Ochlockonee and St. Marks River Basin watersheds addressed in this report are scheduled for TMDL development by September 30, 2003 in a 1999 Consent Decree (FL Wildlife Federation et. al. v. Carol Browner et. al., Case No. 98-35b-CIV-Stafford). These areas are geographically located within the boundaries of the St. Johns River Water Management District (SJRWMD) and the Northwest Florida Water Management District (NWFWMD).

2. Problem Definition

There are 5 segments in the Lower Ochlockonee River Basin and 1 in the St. Marks River Basin (Figure 1 & Table 1) that were identified on the Florida Department of Environmental Protection (FDEP) 1998 303(d) list as impaired for various parameters. These are scheduled for TMDL development by September 30, 2003. This schedule is mandated by a 1999 Consent Decree (Florida Wildlife Federation et. al. v. Carol Browner et. al., Case No. 98-356-CIV-Stafford). The pollutants for which TMDLs will be established are nutrients, dissolved oxygen, BOD, fecal coliform, total coliform, turbidity, and TSS. Reanalysis of these segments in 2003 by FDEP indicated that these parameters may no longer be parameters of concern, and they may not require TMDLs. To meet the requirements of the 1999 Consent Decree though, EPA has taken the lead on establishing the TMDLs for the pollutants of concern for these segments.

Table 9 Impaired WBIDs within the Ochlockonee and St Marks River Basins

Basin	HUC	WBID	Name	Parameters
St. Marks River	03120001	857	Central Drainage Ditch	Nutrients, Fecal Coliforms, Total Coliforms, Turbidity, TSS
St. Marks River	03120001	916	East Drainage Ditch	Fecal Coliforms, Total Coliforms, Nutrients, Turbidity, BOD, TSS
St. Marks River	03120001	820	Godby Ditch	Nutrients, Turbidity, TSS, BOD
St. Marks River	03120001	865	St. Augustine Branch	Nutrients, Fecal Coliforms, Total Coliforms, Turbidity, TSS
St. Marks River	03120001	459	Ward Creek	DO, Fecal Coliforms, Total Coliforms
Ochlockonee River	03120003	746	Harbinwood Estates Drain	Nutrients, BOD
St. Marks River	03120001	756	Northeast Drainage Ditch	Fecal and Total Coliform

The TMDLs addressed in this document are being established pursuant to EPA commitments in the 1998 Consent Decree in the Florida TMDL lawsuit (Florida Wildlife Federation, et al. v. Carol Browner, et al., Civil Action No. 4: 98CV356-WS, 1998). These conditions include a requirement that TMDLs be proposed for the Ochlockonee and St. Marks River Basins by September 30, 2003, for each water on the 1998 303(d) list that is designated as not meeting water quality standards.

In addition to the TMDLs listed in Table 9, EPA is proposing TMDLs developed by FDEP for nutrients in Upper Lake Lafayette (WBID 756A). This TMDL is located in Appendix D. Please refer to that TMDL report for all supporting information.

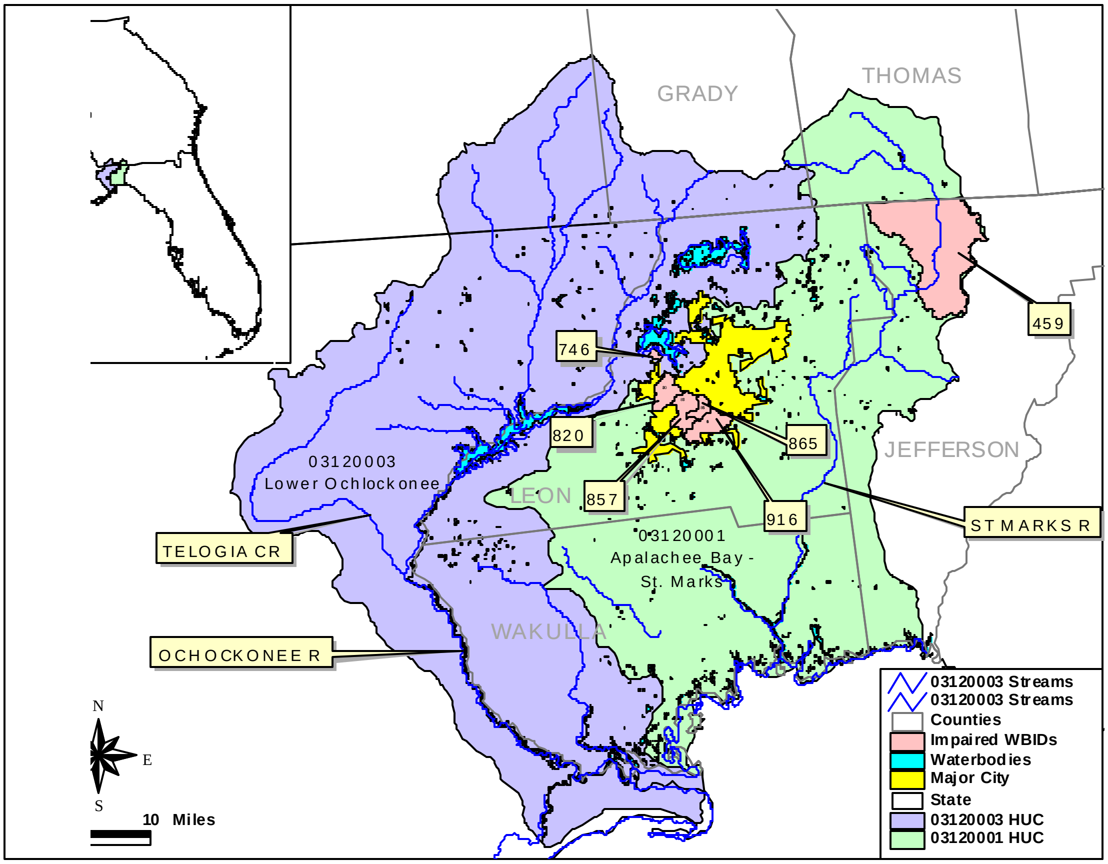

Figure 1 Impaired WBIDs within the Ochlockonee and St. Marks River Basins

3. Watershed Description

The WBIDs in the Lower Ochlockonee River Basin are primarily within an urban setting consisting of the City of Tallahassee and suburban subdivisions. The watershed of Ward Creek (WBID 459) in the St. Marks consists of wetland area and drains a portion of southern Georgia.

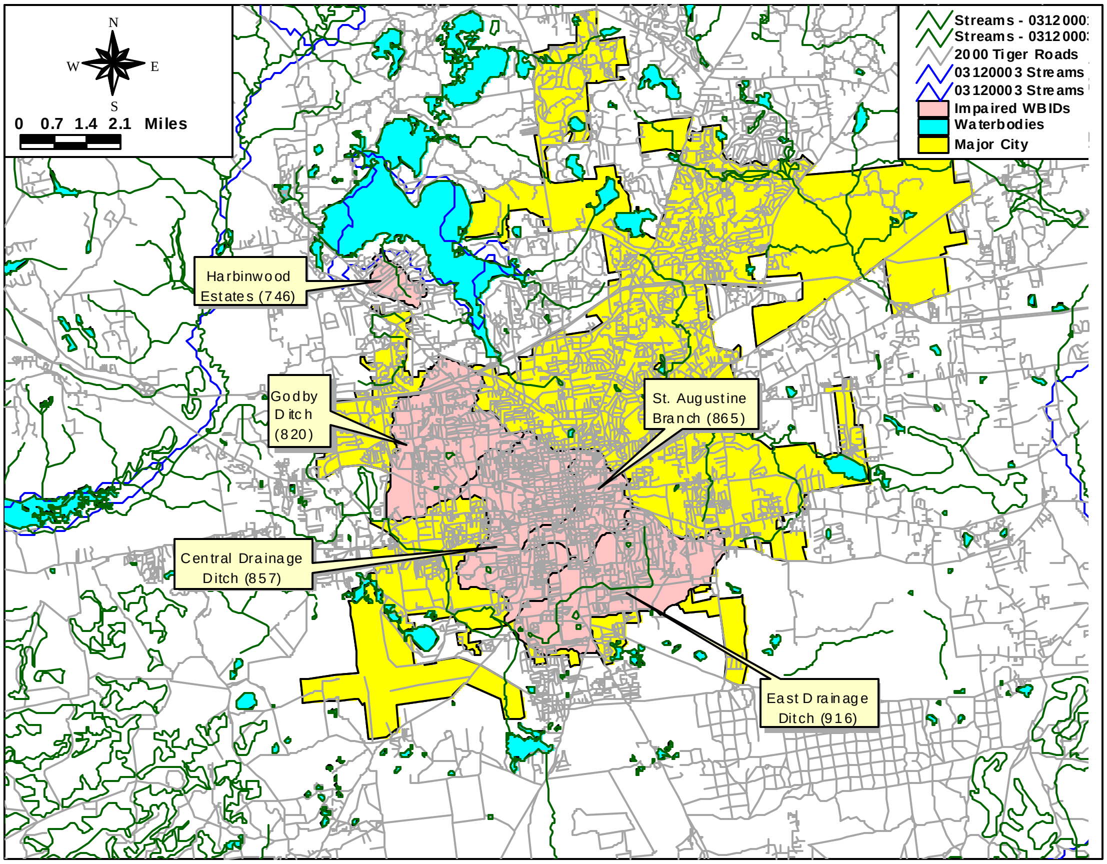

Figure 2 Location Map of Impaired WBIDs in the Lower Ochlockonee River Basin

4. Water Quality Standards

The WBIDs discussed in this TMDL are Class III Freshwater with designated use of Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife (FAC 62-302.400 (1)). The water quality standards in violation that led to the original listing are as follows:

4.1. Narrative Nutrients

"In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna." (FAC 62.302.530 (48)(b))

4.2. Dissolved Oxygen

"Shall not be less than 5.0 mg/L. Normal daily and seasonal fluctuations above these levels shall be maintained." (FAC 62-302.530 (31))

4.3. Biochemical Oxygen Demand

"Shall not be increased to exceed values which would cause dissolved oxygen to be depressed below the limit established for each class and, in no case, shall it be great enough to cause nuisance conditions." (FAC 62-302.530 (12))

4.4. Bacteriological Quality – Fecal Coliform

"Most Probable Number or MF counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of ten samples taken over a 30 day period." (FAC 62-302.530 (6))

4.5. Bacteriological Quality – Total Coliform

The MPN per 100 ml of total coliform bacteria shall be less than or equal to 1,000 as a monthly average nor exceed 1,000 in more than 20 percent of the samples examined during any month, and less than or equal to 2,400 at any time. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period.

4.6. Turbidity/TSS

Expressed as nephelometric turbidity units (NTU)

$\leq$ 29 above natural background conditions

5. Linkage of Water Quality Standards to the Critical Resource

5.1. Narrative Nutrients

Excessive nutrients in a waterbody can have many unfavorable effects on the designated uses of that waterbody. They can affect the drinking water supply, recreational uses, aquatic life uses and fisheries use. Waterbodies are often listed as impaired for nutrients due to their role in accelerating eutrophication in a waterbody. A eutrophic system can easily succumb to excessive plant growth, particularly as phytoplankton, periphyton and macrophytes. The eutrophication process can adversely affect the waterbody by depleting oxygen in the system, infecting water supplies by algal growth and forcing restrictions of recreational uses due to excessive plant growth. In this TMDL, the primary loading is due to wet weather events in an urban setting. The challenge of the TMDL is to link the wet weather loadings to an endpoint such as a concentration or load.

EPA's Ambient Water Quality Criteria Recommendations (EPA, 2000) for rivers and streams suggests establishing nutrient targets based on the 75th percentile of reference stream conditions. If reference streams are not available and/or currently unidentified, the 25th percentile of all streams, including those impaired, can be used as surrogate for an actual reference population when establishing nutrient targets. According to EPA guidance, data analyses to date indicated that the 25th percentile from an entire population roughly approximates the 75th percentile for a reference population. Figure 3 illustrates the concept of frequency distributions of reference streams and all streams.

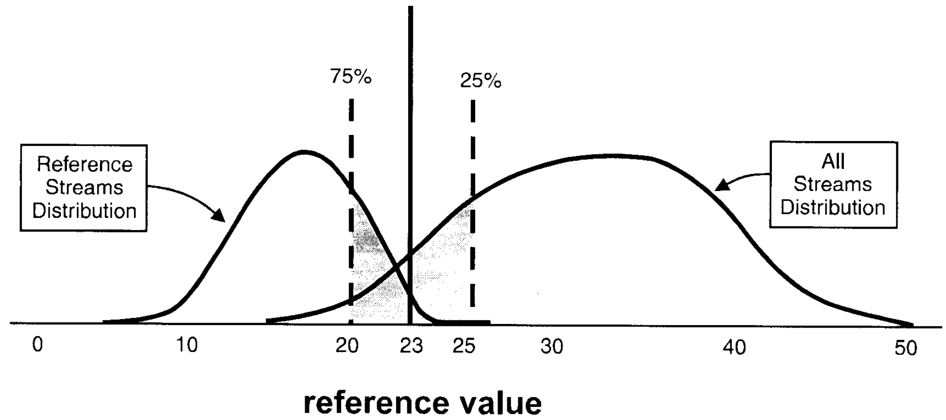

Figure 3 Illustration of Frequency Distributions from the EPA's Nutrient Criteria Technical Guidance Manual for Rivers and Streams (EPA, 2000)

In order to consider nutrient conditions on a regional basis, EPA divided the United States into 14 "aggregate" ecoregions, which are large areas each comprised of a number of distinct "Level III" ecoregions. EPA has published nutrient targets by these "Level ns.

Due to limited time and resources, EPA opted to use the surrogate reference condition approach using the lower quartile (25th percentile) of the distribution from all available data from all streams within a particular ecoregion versus using the preferred method, which is using the upper quartile (75th percentile) of the distribution from data collected at established ecoregion references streams within an ecoregion. Results of EPA's recommended water quality criteria for nutrients, using the surrogate analysis approach to establish TP and TN levels for the ecoregions within the City of Tallahassee are shown in

Table 10. These WBIDs fall within 65o (Tallahassee Hills/Valdosta Limesink) and 75a (Gulf Coast Flatwoods).

Table 10 EPA Recommended Values of TN and TP for Ecoregions (EPA, 2000)

Aggregate Nutrient Ecoregion	Level III Ecoregion	TP (ì g/L)	TN (ì g/L)
	65	22.5	618
XII	75	40	900

To develop a translation from the narrative nutrient criterion, a reference stream approach was performed using ecoregion reference stream data collected by FDEP. There were 11 stations obtained from an environmental specialist at FDEP and nine were determined to have adequate nutrient data available. These stations are shown in Table 11. Using EPA protocol for developing nutrient targets in rivers and streams (EPA, 2001), the 75th percentile of the reference data were computed for TN and TP targets as 720 and 77 µg/L, respectively. All of the reference results are shown in Table 12.

Table 11 Reference Stream Candidate List

STORET_ID	STANICKNAME	STADESC
22020320	BURNTUNK	Burnt mill Creek-up from hwy 27
22030061	LLOYDREF	LLOYD CREEK S.R.158A JEFFERSON CO.
22030074	MOOREBR	Moore Branch above Cody Road
31010140	NMOS REF	North Mosquito Ck
22020062	OKLREF	Oklawaha Ck
22030089	POLARUNK	Polar Crk- @ 59
22040022	WELREF	WELAUNEE CREEK JEFFERSON CO. W.OF IAMONIA LK.
31010050	CRKREF	Crooked Creek @ HWY 270 Gadsden Co.
31010142	FLTREF	Flat Creek @ HWY 12 Gadsden Co.
22020049	MULEREF	Mule Creek @ SR12 Liberty Co.
31010051	SWTREF	Sweetwater Creek @ HWY 270 Liberty Co.

Table 12 Summary of TMDL Targets

Parameter	Units	No of Stations	No of Data Points	75th Percentile of All Reference Data	75th Percentile of Reference Medians	TMDL Target
BOD5	mg/L	5	11	0.60	0.40	2.0
Turbidity	NTU	7	32	16.25	13.23	29
TN	mg/L	7	47	0.72	0.68	0.72
TP	mg/L	7	47	0.077	0.12	0.077

5.2. Dissolved Oxygen

Extreme oxygen depletion can stress or eliminate desirable aquatic life and nutrients, and due to lowered dissolved oxygen, toxins may be released from the sediments, further adversely affecting aquatic life. In this TMDL, the assumption is made that low levels of dissolved oxygen are a function of nutrient enrichment and elevated biochemical oxygen demand. By addressing nutrient enrichment and BOD, any remaining depressed DO levels are likely to be the result of natural background conditions typically observed in warm weather, shallow, slow moving streams.

5.3. Biochemical Oxygen Demand

Bacteria feed on organic matter discharged into the water, or from decaying plants and animal wastes. As the organic substances are decomposed by the bacteria, dissolved oxygen in the water is consumed. If large quantities of such matter are discharged into the water the bacteria's biochemical oxygen demand (BOD) can seriously deplete dissolved oxygen levels in the water. High levels of BOD in these WBIDs are due to urban sources such as pet waste in neighborhoods and leaf litterfall from riparian areas and yards.

5.4. Fecal Coliform

Fecal coliform bacteria in the water column can induce gastrointestinal, respiratory, eye, ear, nose and throat illnesses and skin diseases in humans. In addition, fecal coliform are used as an indicator of the likely presence of pathogens that pose other potential health risks (EPA, 2001). For this TMDL the water quality target for fecal coliform is the State of Florida numeric criterion of 400 cfu per 100 milliliters of water. This target is applied across a wide range of flow conditions using a loading curve approach in order to determine the average daily load of fecal coliform cfu that would meet the water quality criteria.

5.5. Total Coliform

The target for the total coliform TMDLs is the one-day maximum concentration of 2400 counts/100mL, as less than 10 samples were collected in a 30-day period to determine violations of the not to exceed percentage criterion or the geometric mean. Total coliform bacteria generally indicate the presence of soil-associated bacteria and result from natural influences on a water body such as rainfall runoff as well as sewage inflows (i.e., acute conditions). By protecting the acute criteria (i.e., one-day maximum) bacteria concentrations in the stream should meet the chronic criteria.

5.6. Turbidity/TSS

The target for turbidity/TSS is less than or equal to 29 NTU above natural background conditions.

6. Water Quality Assessment

6.1. Water Quality Data

For this effort, readily available water quality data and information have been assembled to support an up-to-date assessment of the water quality conditions and designated use support of the impaired segments within the Ochlockonee and St.Marks River Basins. Water quality data from two water quality databases were obtained from FDEP and the SJRWMD. Efforts were made to solicit additional readily available water quality data from other agencies and entities that have collected data within the watershed. The databases used for this analysis were the most complete and current sources of relevant water quality data. These data are available for download from the Florida Environmental Data Extraction Tool (FEDET) at the following address: http://fedet.tetratech-ffx.com/fedet/index.jsp. Water quality assessment for Northeast Drainage Ditch (WBID 756) is included in Appendix C.

The City of Tallahassee provided the MS4 stormwater sample results from 1996 through 2001. These data were useful in determining the wet weather loadings from the stormwater catchment areas.

7. Source and Load Assessment

EPA personnel with FDEP staff visited all of these streams during 2003 to perform stream walks and general site assessments.

7.1. Nutrients

Nutrients enter surface waters from both point and nonpoint sources. Point sources are facilities that discharge at a specific location from pipes, outfalls, and conveyance channels from either municipal wastewater treatment plants or industrial waste treatment facilities. All point sources must have a National Pollutant Discharge Elimination System (NPDES) permit.

Point source contributions can typically be attributed to the following sources:

- Municipal wastewater facilities
- Municipal Separate Storm Sewers (MS4s)

Nonpoint sources are diffuse sources that have multiple routes of entry into surface waters. Nonpoint sources can be attributed in a variety of ways. However, one common approach is to estimate or calculate nonpoint source loads based on land use type. In this analysis, nonpoint sources are broken out and loads are calculated by land use category using the Florida Land Use, Cover, and Forms Classification System (FLUCCS) scheme (Table 13). Land use categories can be broken into nine primary categories, and then more refined classifications are available at the FLUCCS Level 2 and Level 3.

Table 13 Nonpoint Source Land Use Categories from FLUCCS Level 1 Classification Scheme

Land Use Category	FLUCCS Code
Urban and Built Up	1000
Agriculture	2000
Rangeland	3000
Upland Forests	4000
Water	5000
Wetlands	6000
Barren Land	7000
Transportation, Communications and Utilities	8000

Table 14 Land Use (Square Miles) for the Impaired WBIDs

		Land Use Area (sq miles)								
Name	WBID	Urban and Built Up	Agriculture	Rangelands	Upland Forests	Water	Wetlands	Barren Land	Transportation, Communication and Utilities	Total
Lake Iamonia	442	3.46	5.64	0.24	45.21	1.26	13.41	0.00	0.18	69.40

Ward Creek	459	1.65	16.98	0.00	37.08	0.31	5.86	0.17	0.10	62.14
Harbinwood Estates	746	0.75	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.79
Godby Ditch	820	4.31	0.00	0.00	1.12	0.02	0.04	0.00	0.06	5.56
Central Drainage Ditch	857	5.64	0.00	0.00	0.28	0.03	0.04	0.00	0.08	6.06
St. Augustine Branch	865	2.44	0.00	0.00	0.00	0.01	0.00	0.00	0.06	2.51
East Drainage Ditch	916	5.03	0.06	0.00	1.34	0.07	0.18	0.00	0.00	6.69

Table 15 Land Use (Percentages) for the Impaired WBIDs

		Land Use Area (Percentage)								
Name	WBID	Urban and Built Up	Agriculture	Range Lands	Upland Forests	Water	Wetlands	Barren Land	Transportation, Communication and Utilities	Total
Lake Iamonia	442	5.0%	8.1%	0.3%	65.1%	1.8%	19.3%	0.0%	0.3%	100%
Ward Creek	459	2.6%	27.3%	0.0%	59.7%	0.5%	9.4%	0.3%	0.2%	100%
Harbinwood Estates	746	95.7%	0.0%	0.0%	0.0%	1.0%	0.0%	0.0%	3.3%	100%
Godby Ditch	820	77.6%	0.0%	0.0%	20.2%	0.4%	0.7%	0.0%	1.1%	100%
Central Drainage Ditch	857	93.0%	0.0%	0.0%	4.6%	0.4%	0.6%	0.0%	1.3%	100%
St. Augustine Branch	865	97.5%	0.0%	0.0%	0.0%	0.2%	0.1%	0.0%	2.2%	100%
East Drainage Ditch	916	75.1%	0.9%	0.0%	20.1%	1.1%	2.7%	0.0%	0.1%	100%

7.2. Fecal Coliforms

Fecal coliform can be delivered to a stream through a wide variety of point and nonpoint sources. There are no known point sources within the Mill Branch watershed, so this source assessment focuses on likely nonpoint sources. Potential nonpoint sources of fecal coliform include domestic pets, animal feedlots, wildlife, septic systems, livestock, pastures, boat pumpouts, landfills and the land application of manure and sludge (EPA 2001). A review of 1995 land uses indicates that Mill Branch watershed contains a mixture of low and medium density residential, row crops, rangelands and forests. Thus, it is highly likely that fecal coliform sources in this watershed include everything from wildlife and domestic pets, to livestock and pastures, to failing septic systems and urban stormwater. It is unknown whether any of the local potato and cabbage farms are applying manure as a source of fertilizer, but it could be possible as a pre-plant practice.

A review of available water quality and nearby flow data indicates violations of the fecal coliform criterion occur at both high and low flow conditions indicating there is no one source and mechanism responsible for delivering fecal coliform to Mill Branch.

The Northeast Drainage Ditch (WBID 756) is within the Lake Lafayette Drain in Leon County, Florida. Water movement through the Lake Lafayette system of lakes is very complex. Lake Lafayette Drain, which drains into Upper Lake Lafayette, is made up of four tributaries: the Northeast Drainage Ditch (NED), Lafayette Creek, a small tributary from the north of the lake, and Lake Piney Z. Of these four, the Northeast Drainage Ditch and Lafayette Creek are the major sources of flow to the lake. The Northeast Drainage Ditch has its headwaters about six miles north of Upper Lake Lafayette and meanders through a highly urbanized section of Tallahassee. Two urban tributaries, McCord Park Ditch and Park Avenue Ditch, join the Northeast Drainage Ditch before its confluence with Upper Lake Lafayette. Lafayette Creek, with its headwaters approximately three miles from the lake, also flows directly into Upper Lake Lafayette. Recent development has made Lafayette Creek a more urbanized system over the past few decades.

Upper Lake Lafayette is the westernmost lake in the Lafayette Lake system. It is highly variable in regards to area and volume, and it exchanges flow with its neighboring lake to the east, Piney Z, at high water level conditions. Piney Z, which has no major tributaries, maintains its water levels and is the central lake in the system. Lower Lake Lafayette, whose major tributary is Alford Arm, is the easternmost lake and connects this entire lake system to the St Marks River. Table 16 contains a detailed land use distribution in the WBID developed by the City of Tallahassee (ERD, 2002).

Table 16. Land Cover Features in WBID 756 (acres)

ROAD	COMMERCIAL	SINGLE FAMILY LOW DENSITY	SINGLE FAMILY HIGH DENSITY	MULTI-FAMILY RESIDENTIAL	INDUSTRIAL	MEDIUM DENSITY RESI-DENTIAL	OPEN WATER / LAKE	REATIONAL / OPEN SPACE	TOTAL WATERSHED
3847.17	2390.28	12735.59	700.56	899.96	204.90	6297.14	300.59	25755.37	53131.55

7.3. Point Sources

7.3.1. Permitted Point Sources

Since 1984, all of the significant point sources have been removed from direct discharge to the drainage basin. Most of the treated effluent is land-applied. Other point sources are nonsurface discharges with sprayfields or percolation ponds. Possible reductions would have to be considered in the load allocation portion of this TMDL.

7.3.2. Municipal Separate Storm System Permits

Municipal Separate Storm Sewer Systems (MS4s) are point sources also regulated by the NPDES program. Discharge from storm water pipes or conveyances potentially include urban runoff high in bacteria and other pollutants. In 1990, EPA developed rules establishing Phase I of the National Pollutant Discharge Elimination System (NPDES) storm water program, designed to prevent harmful pollutants from being washed by storm water runoff into Municipal Separate Storm Sewer Systems (MS4s) (or from being dumped directly into the MS4) and then discharged from the MS4 into local waterbodies. Phase I of the program required operators of “medium” and “large” MS4s (those generally serving populations of 100,000 or greater) to implement a storm water management program as a means to control polluted discharges from MS4s. Approved storm water management programs for medium and large MS4s are required to address a variety of water quality related issues including roadway runoff management, municipal owned operations, hazardous waste treatment, etc. The City of Tallahassee and Leon County are covered under Phase I of the program and impact the Northeast Drainage Ditch.

Phase II of the rule extends coverage of the NPDES storm water program to certain “small” MS4s. Small MS4s are defined as any MS4 that is not a medium or large MS4 covered by Phase I of the NPDES Storm Water Program. Only a select subset of small MS4s, referred to as “regulated small MS4s”, require an NPDES storm water permit. Regulated small MS4s are defined as all small MS4s located in "urbanized areas" as defined by the Bureau of the Census, and those small MS4s located outside of a UA that are designated by NPDES permitting authorities. For the purpose of this TMDLs MS4 outfalls will have to meet the percent reductions as prescribed for the nonpoint sources. Best management practices will need to be developed to achieve the reductions in nutrients and sediments as prescribed by the TMDL.

7.4. Nonpoint Sources

Nonpoint sources contribute a greater annual load of nutrients into this region of the than do point sources. Nonpoint sources represent contributions from diffuse sources, rather than from a defined outlet. On the land surface, nutrients accumulate over time from diverse sources such as dead plant matter, fertilizers, and atmospheric deposition. This accumulation of nutrients is washed from the land surface into the adjacent water body.

The land use distribution of the Ochlockonee and St. Marks River Basins provides insight into determining nonpoint sources of nutrients. Figure 4 displays land uses by WBID.

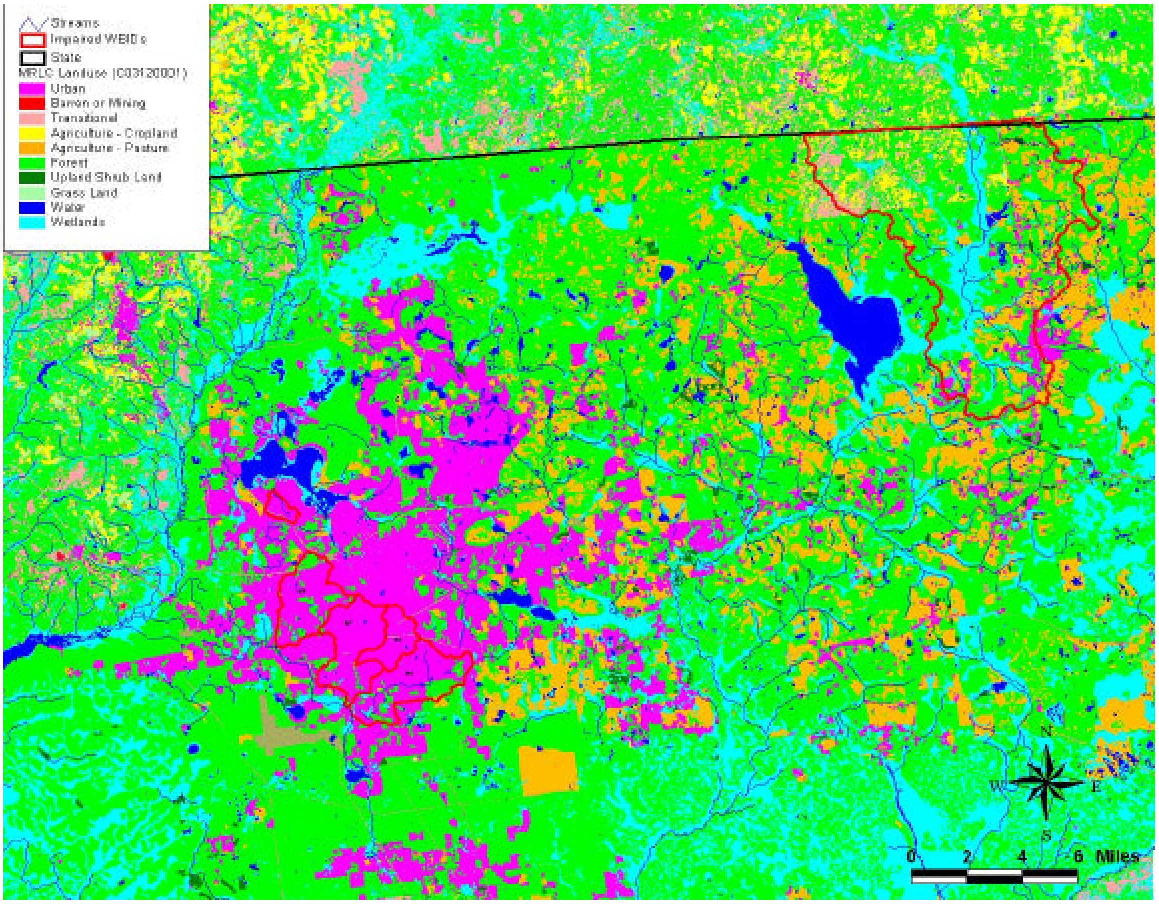

Figure 4 Land Uses within the Ochlockonee and St. Marks

Urban and built up lands include uses such as residential, industrial, extractive and commercial. Land uses in this category in the LSJR watershed have high total nitrogen event mean concentrations, average total phosphorus event mean concentrations and some of the highest BOD event mean concentrations. Urban and built land uses occur throughout the TMDL segments.

Upland Forests include flatwoods, oak, various types of hardwoods, conifers and tree plantations. Event mean concentrations for upland forests are low for both total nitrogen and total phosphorus, but high for BOD. This landuse is aggregated with rangeland and barren lands.

8. Technical Approach

Large watersheds with distinct subwatersheds, varied land uses and soil types, and numerous potential sources of pollutants require, at a minimum, a model or tool that allows one to consider the interaction of these factors in a spatially distributed context. These interactions have a significant influence on the total loads of the pollutants in question that are ultimately delivered to the system.

8.1. Nutrients and BOD

Selection of the appropriate analytical tool is important to determine point and nonpoint source impacts on the water quality. Due to the limited dataset available, including flow and water quality, a simple approach was determined to be the most technically defensible. The source assessments along with the City of Tallahassee's wet weather data were considered into the approach. Once the TMDL targets were defined as discussed in Section 5.1, the data for each WBID were summarized and a median was calculated for TN, TP, and BOD5. These medians were compared to the target and a percent reduction was computed.

8.2. Fecal Coliform

The only WBIDs that had a considerable amount of fecal coliform or total coliform data were Ward Creek and Northeast Drainage Ditch. For the other WBIDs, a straight comparison was calculated based on the highest fecal coliform concentration.

For Ward Creek and Northeast Drainage Ditch, coliform loads were calculated using the EPA Region 4 recommended loading curve approach. Daily average flow data from 1998 to 2001 from the USGS gauge on Lost Creek at Arran, Florida (02327033) were used to generate a proportioned load duration curve for Ward Creek. The drainage area for the Lost Creek gage is 70.0 square miles and Ward Creek is approximately 62.14 square miles. The Northwest Florida Water Management District (NWFWMD) maintains a continuous flow gages at the intersection of US 90 and the Northeast Drainage Ditch (FDEP water quality station 685) and a gage in WBID 863, Park Avenue Ditch at Mahan Drive. FDEP water quality Station 690 is situated just after the confluence of the Park Avenue and the Northeast Ditches. Flows at Station 690 are calculated as the sum of flows at these two gages. With the knowledge of a flow at Station 690 and a drainage area, approximately 10,175 acres (City of Tallahassee), it is possible to estimate a flow at Station 695. The flow duration curve for Northeast Drainage Ditch is included in Appendix D.

Flow duration curves are transformed into load duration curves by multiplying the flow values along the flow duration curve by the coliform concentration and the appropriate conversion factors. On the load duration curve, allowable and existing loads are plotted against the flow recurrence interval. Coliform counts measured between 1998 and 2001 in Ward Creek and were plotted based on the estimated flow when the sample was taken. A best fit line was then drawn between the measured violations ("Expon (Violations)") in order to calculate the current fecal coliform loads in Ward Creek (Figure 5). Load duration curves for Northeast Drainage Ditch are provided in Appendix D. Table 17 presents the TMDL load calculation.

To ensure the fecal coliform TMDL developed for Northeast Drainage Ditch is protect of both the one-day maximum criterion and not to exceed criterion, the percent reduction calculated from the load curve analysis was compared to the reduction calculated based on an analysis of the data. The criteria resulting in the highest percent reduction is used for the TMDL. The water quality standard for fecal coliform allows 10 percent of the samples to exceed 400 counts/100ml. Fecal coliform data collected at Station 695 includes 117 samples as shown in Appendix A. By excluding 10 percent of the samples exceeding a concentration of 400, the highest remaining concentration is about 5000 counts/100ml. A 92 percent reduction in fecal coliform loading is required to meet the standard. The load curve analysis evaluated the 800 criteria and resulted in a 65 percent reduction.

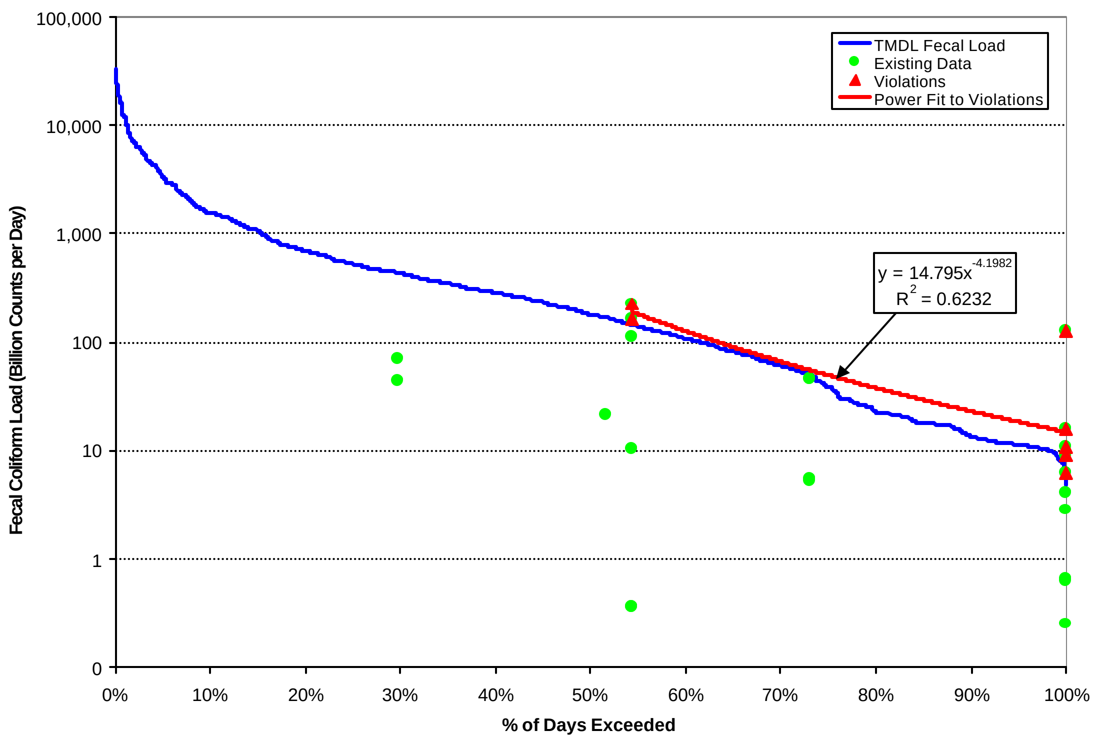

Figure 5 Load Duration Curve for Fecal Coliform in Ward Creek

Table 17 Fecal Coliform TMDL Load Calculation for Ward Creek

Date	Station	Station Description	Fecal Coliform (counts per 100 mL)	Units	Flow (cfs)	% Exceedance	Fecal Coliform Load (counts per day)	TMDL Load (counts per day)	% Reduction
11/5/2001	21FLDEP 304736908358575	WARD CRK AT MAGNOLIA RD 1.9 MI S PINE	700	100ml	0.64	100%	1.09E+10	4.79E+09	56%
11/5/2001	21FLDEP 304702008359058	WARD CRK AT MAGNOLIA RD 1.9 MI S PINE	1000	100ml	0.64	100%	1.56E+10	4.79E+09	69%
11/5/2001	21FLDEP 303730308352213	TRIB TO WARD CRK AT US 19 ABT 5.4 MI N	8000	100ml	0.64	100%	1.25E+11	4.79E+09	96%
11/5/2001	21FLDEP 304816608359266	TRIB TO WARD CRK AT HABERSHAM RD	570	100ml	0.64	100%	8.90E+09	4.79E+09	46%
11/5/2001	21FLDEP 303618108353357	WARD CRK AT SR 259 (SR 142)	580	100ml	0.64	100%	9.06E+09	4.79E+09	47%

11/5/2001	21FLDEP 304511808357587	WARD CRK AT MILLPOND RD 3.2 MI N NEW	400	100ml	0.64	100%	6.25E+09	4.79E+09	23%
2/16/1999	21FLDEP 303730308352213	TRIB TO WARD CRK AT US 19 ABT 5.4 MI N	620	100ml	14.90	54%	2.25E+11	1.45E+11	35%
2/16/1999	21FLDEP 304124808354140	WARD CRK AT 12 MILE POST RD	450	100ml	14.90	54%	1.64E+11	1.45E+11	11%
						average =	7.06E+10	4.00E+10	43%

9. TMDL

A total maximum daily load (TMDL) for a given pollutant and waterbody is comprised of the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for both nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is represented by the equation:

$$TMDL = WLAs + LAs + MOS$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving waterbody while still achieving water quality standards. A portion of the TMDL allocated to each of the pollutant sources as WLA for point source and LA for non point source. The allocations for all pollutant sources are identified that cumulatively provide for the basis for the State or WMD to prescribe controls that will ultimately achieve water quality standards. For nutrients, TMDLs can be expressed on a mass loading basis (e.g., pounds per day or year).

Table 18 Ward Creek (459) TMDL Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (Stormwater) % Reduction	LA % Reduction
TN (mg/L)	0.39	0.72	0%	0%
TP (mg/L)	0.09	0.08	18%	18%
BOD5 (mg/L)	0.83	2.00	0%	0%
Fecal Coliform (counts/day)	7.06E+10	4.00E+10	43%	43%
Total Coliform (#/100mL)	2,500	2,400	4%	4%

Table 19 Harbinwood Estates (746) TMDL Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (Stormwater) % Reduction	% Reduction
TN (mg/L)	0.70	0.72	0%	0%
TP (mg/L)	0.21	0.08	64%	64%
BOD5 (mg/L)	0.54	2.00	0%	0%

Table 20. Northeast Drainage Ditch (756) TMDL Load Allocation Summary

Stream and Station	Parameter	WLA		LA	TMDL[1] (counts/day)	Percent Reduction[2]
		Wastewater	Stormwater			
NED S695	Fecal	0	92% reduction[2]	1.17E12	1.17E12	92
NEW S695	Total	0	78% reduction[2]	3.52E12	3.52E12	78

[1] The TMDL represents the average allowable load between the 10th and 90th percent recurrence interval.

[2] The overall percent reduction needed to achieve the in-stream water quality criteria of 400 counts/100mL for Fecal Coliform, or 2400 counts/100mL for Total Coliform.

Table 21 Godby Ditch (820) TMDL Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (Stormwater) % Reduction	% Reduction
TN (mg/L)	0.36	0.72	0%	0%
TP (mg/L)	0.15	0.08	50%	50%
BOD5 (mg/L)	1.86	2.00	0%	0%
Turbidity (NTU)	9.6	29	0%	0%

Table 22 Central Drainage Ditch (857) TMDL Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (Stormwater) % Reduction	% Reduction
TN (mg/L)	0.70	0.72	0%	0%
TP (mg/L)	0.12	0.08	37%	37%
Fecal Coliform (#/100mL)	730	400	45%	45%
Total Coliform (#/100mL)	22,867	2,400	90%	90%
Turbidity (NTU)	5.95	29	0%	0%

Table 23 St. Augustine Branch (865) Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (Stormwater) % Reduction	% Reduction
TN (mg/L)	0.51	0.72	0%	0%
TP (mg/L)	0.11	0.08	29%	29%
Fecal Coliform (#/100mL)	760	400	47%	47%
Total Coliform (#/100mL)	16000	2400	85%	85%
Turbidity (NTU)	1.6	29	0%	0%

Table 24 East Drainage Ditch (916) Load Allocation Summary

Parameter	Existing	TMDL Target	WLA (Stormwater) % Reduction	% Reduction
TN (mg/L)	0.55	0.72	0%	0%
TP (mg/L)	0.13	0.08	37%	37%
BOD5 (mg/L)	0.52	2.00	0%	0%
Fecal Coliform (#/100mL)	3,400	400	88%	88%
Total Coliform (#/100mL)	11,000	2,400	78%	78%
Turbidity (NTU)	29.91	29	3%	3%

9.1. Critical Conditions

The critical condition for nonpoint source loadings are typically an extended dry period followed by a rainfall runoff event. During the dry weather period, pollutants build up on the land surface, and are then washed off by rainfall. The critical condition for point source loading occurs during periods of low stream flow when dilution is minimized. Water quality data have been collected during both time periods, and most of the exceedances occur during median to high flow conditions, indicating predominantly nonpoint sources.

9.2. Margin of Safety

There are two methods for incorporating the MOS (USEPA, 1991):

- Implicitly incorporate the MOS using conservative model assumptions to develop allocations
- Explicitly specify a portion of the total TMDL as the MOS and use the remainder for Allocations

For the Ochlockonee and St. Marks River Basins nutrient and BOD TMDLs, an explicit margin of safety was applied. This was accomplished in the following ways:

- 10% applied to all TMDL targets.
- NPDES permitted facilities were represented in the model using maximum permitted discharges.

For the coliform TMDLs an implicit MOS was assumed because the percent reduction calculations do not allow for instream decay of fecal coliform.

9.3. Seasonal Variability

Seasonality is incorporated in this TMDL through the use of annual average loads and seasonal event mean concentrations and runoff coefficients. This approach includes both the influences of wet and dry weather conditions on loadings to the waterbody. Furthermore, the use of multi-year analysis in the development of current loadings incorporates a range of wet and dry years.

9.4. Load Allocation

The TMDLs and their components (WLA, LA, and MOS) were derived based on an interpretation of the model results and water quality standards. The TMDLs are presented below for total nitrogen, total phosphorus and BOD for the entire study area, and are calculated to achieve the narrative nutrient criteria. Achieving the narrative nutrient criteria will also result in achieving appropriate dissolved oxygen and chlorophyll regimes as these impairments are a direct result of symptoms associated with cultural eutrophication caused by nutrient enrichment.

9.5. Wasteload Allocations

9.5.1. Municipal Separate Storm System Permits

Municipal Separate Storm Sewer Systems (MS4s) are point sources also regulated by the NPDES program. Discharge from storm water pipes or conveyances potentially include urban runoff high in bacteria and other pollutants. In 1990, EPA developed rules establishing Phase I of the National Pollutant Discharge Elimination System (NPDES) storm water program, designed to prevent harmful pollutants from being washed by storm water runoff into Municipal Separate Storm Sewer Systems (MS4s) (or from being dumped directly into the MS4) and then discharged from the MS4 into local waterbodies. Phase I of the program required operators of “medium” and “large” MS4s (those generally serving populations of 100,000 or greater) to implement a storm water management program as a means to control polluted discharges from MS4s. Approved storm water management programs for medium and large MS4s are required to address a variety of water quality related issues including roadway runoff management, municipal owned operations, hazardous waste treatment, etc.

Phase II of the rule extends coverage of the NPDES storm water program to certain “small” MS4s. Small MS4s are defined as any MS4 that is not a medium or large MS4 covered by Phase I of the NPDES Storm Water Program. Only a select subset of small MS4s, referred to as “regulated small MS4s”, require an NPDES storm water permit. Regulated small MS4s are defined as all small MS4s located in "urbanized areas" as defined by the Bureau of the Census, and those small MS4s located outside of a UA that are designated by NPDES permitting authorities.

For the purpose of this TMDLs MS4 outfalls will have to meet the percent reductions as prescribed for the nonpoint sources. Best management practices will need to be developed to achieve the reductions in nutrients and sediments as prescribed by the TMDL.

10.References

EPA, 2000. Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria. Rivers and Streams in Ecoregion XI. United States Environmental Protection Agency, Office of Water. EPA 822-B-00-020.

EPA, 2000. Nutrient Criteria Technical Guidance Manual: River and Streams. United States Environmental Protection Agency, Office of Water. EPA 822-B-00-002.

Appendix A – Impaired WBID Figures

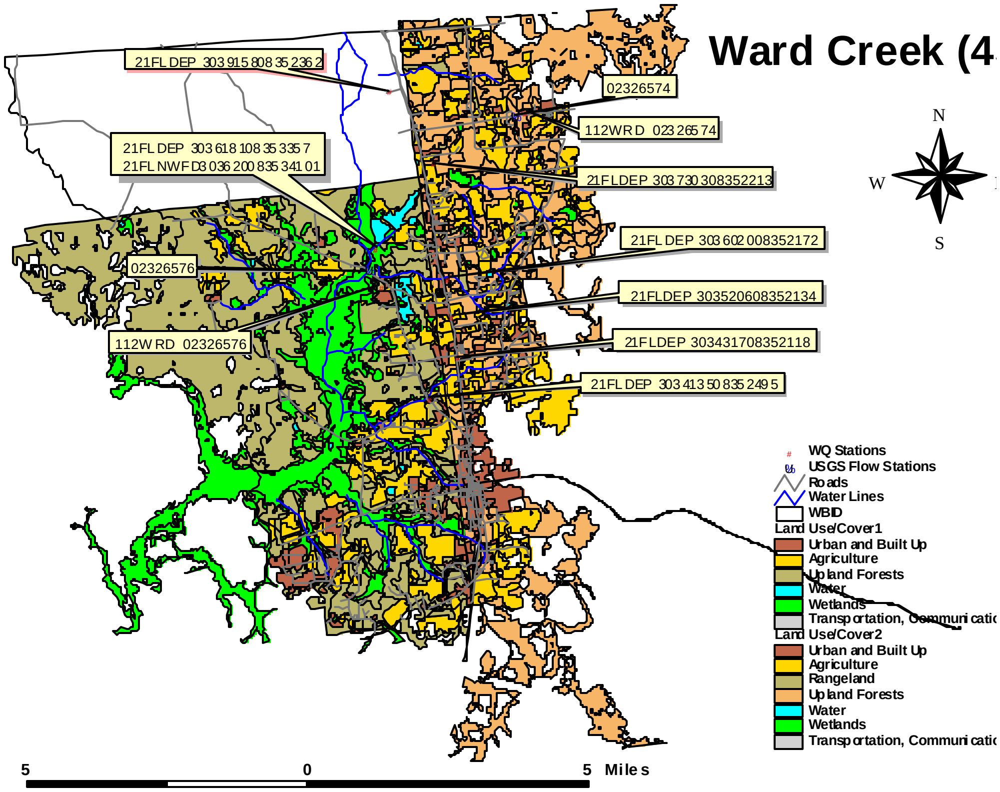

Figure 6 Ward Creek (459) Location Map

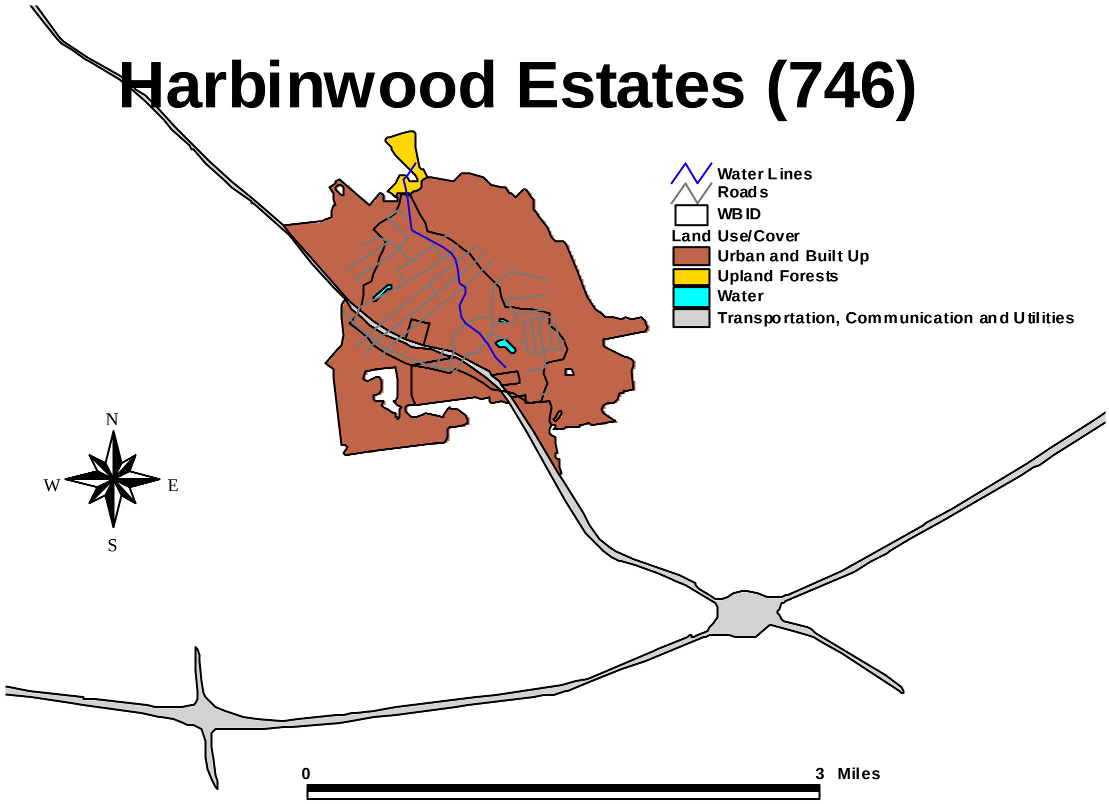

Figure 7 Harbinwood Estates (746) Location Map

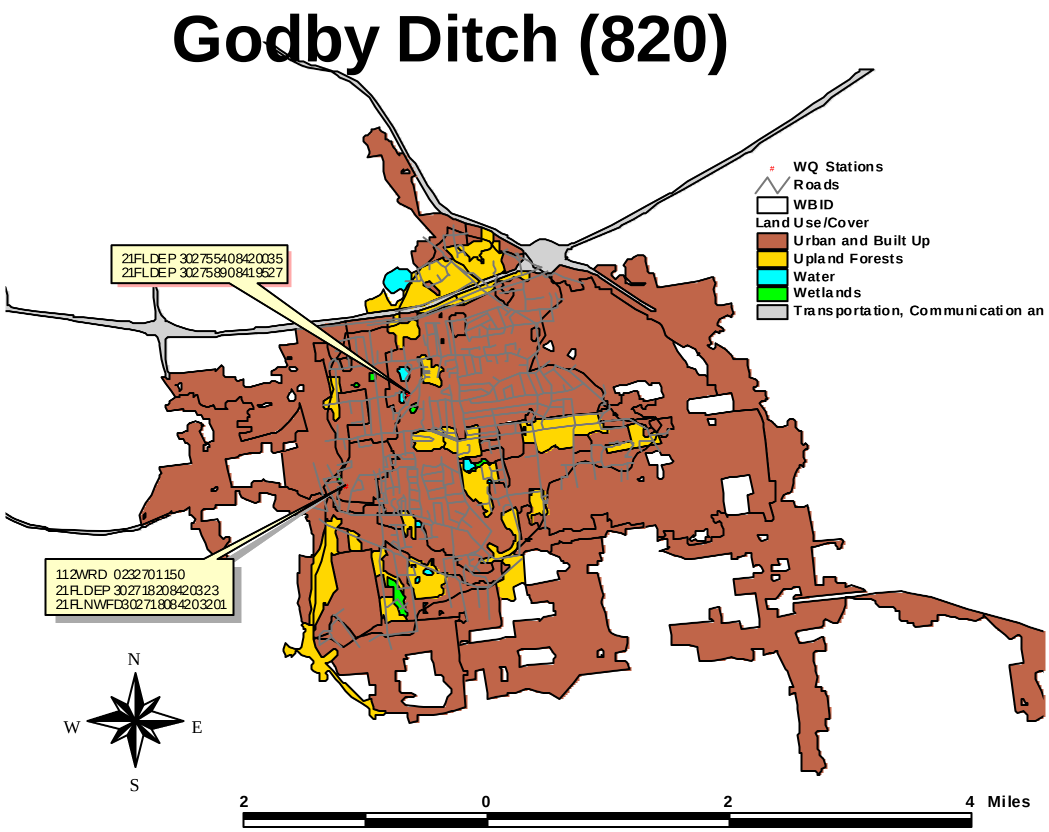

Figure 8 Godby Ditch (820) Location Map

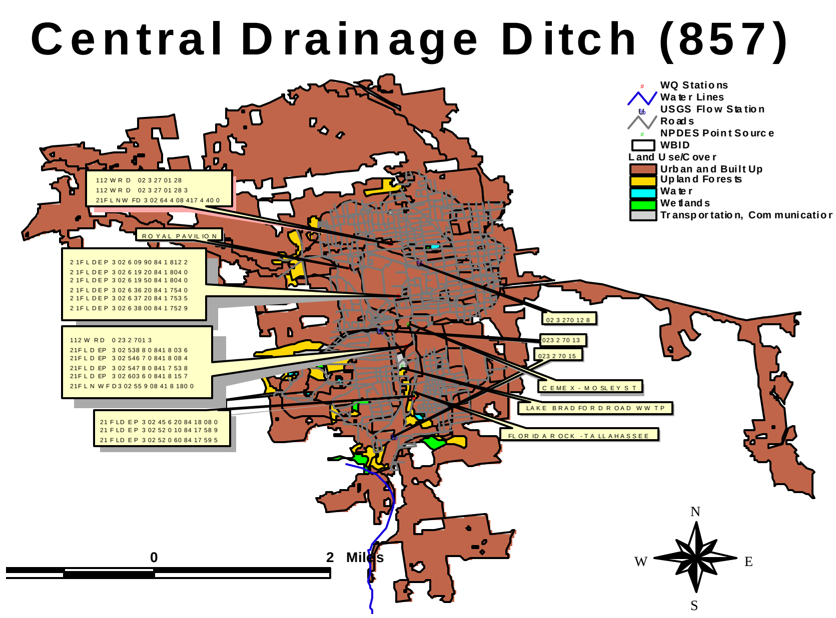

Figure 9 Central Drainage Ditch (857) Location Map

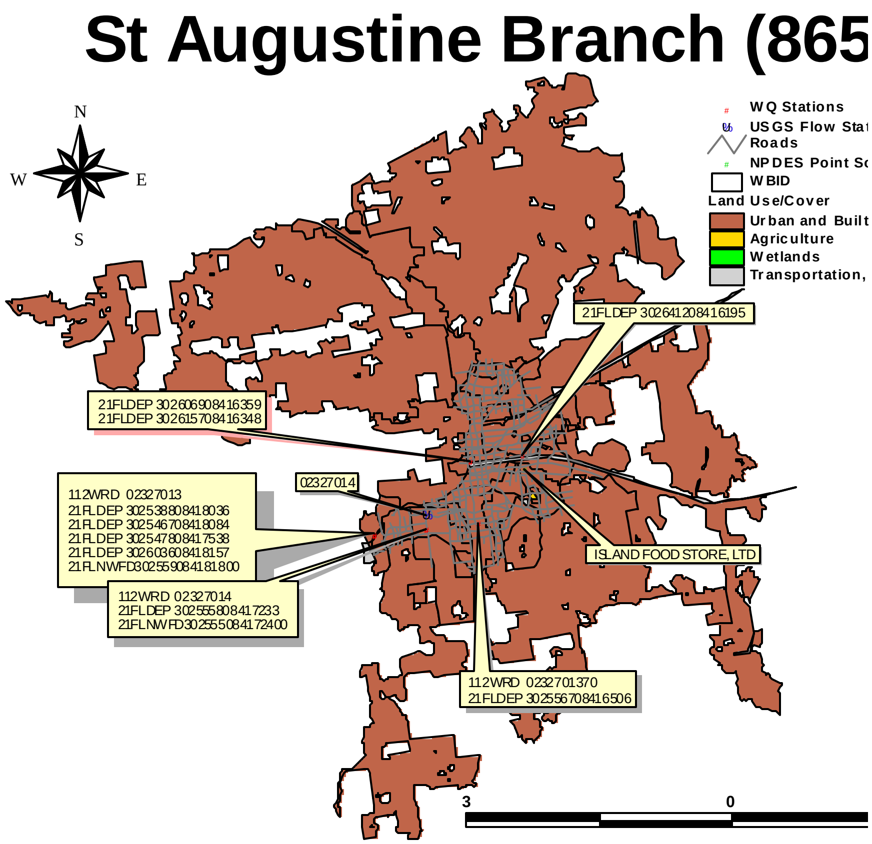

Figure 10 St. Augustine Branch (865) Location Map

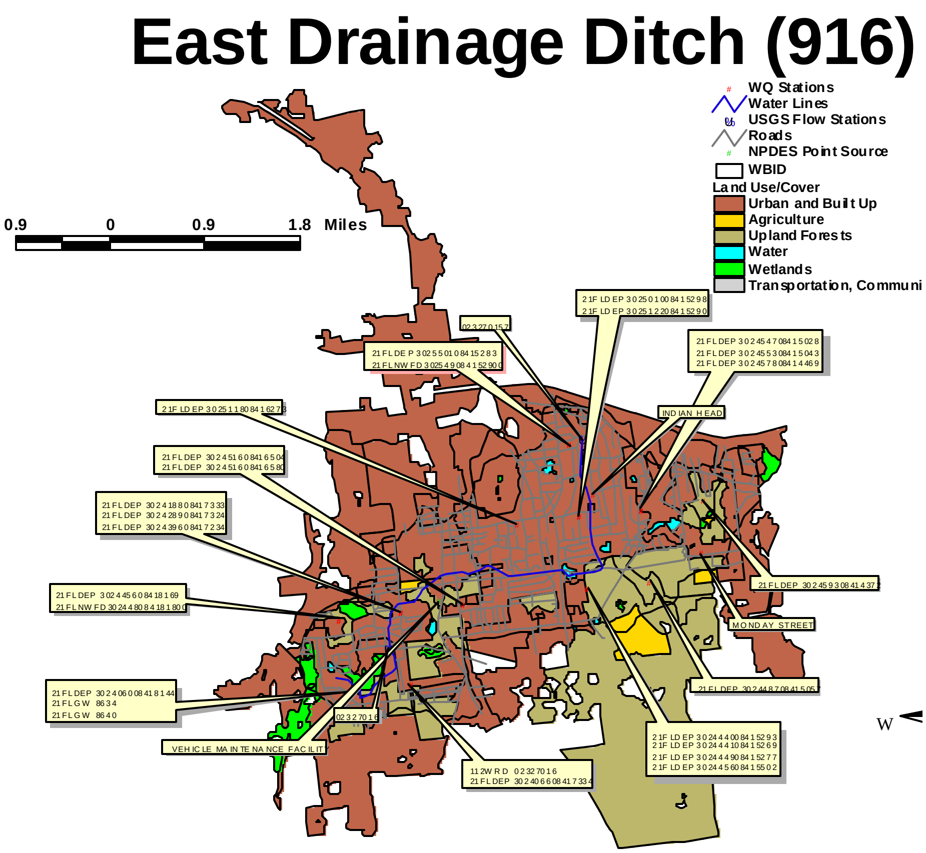

Figure 11 East Drainage Ditch (916) Location Map

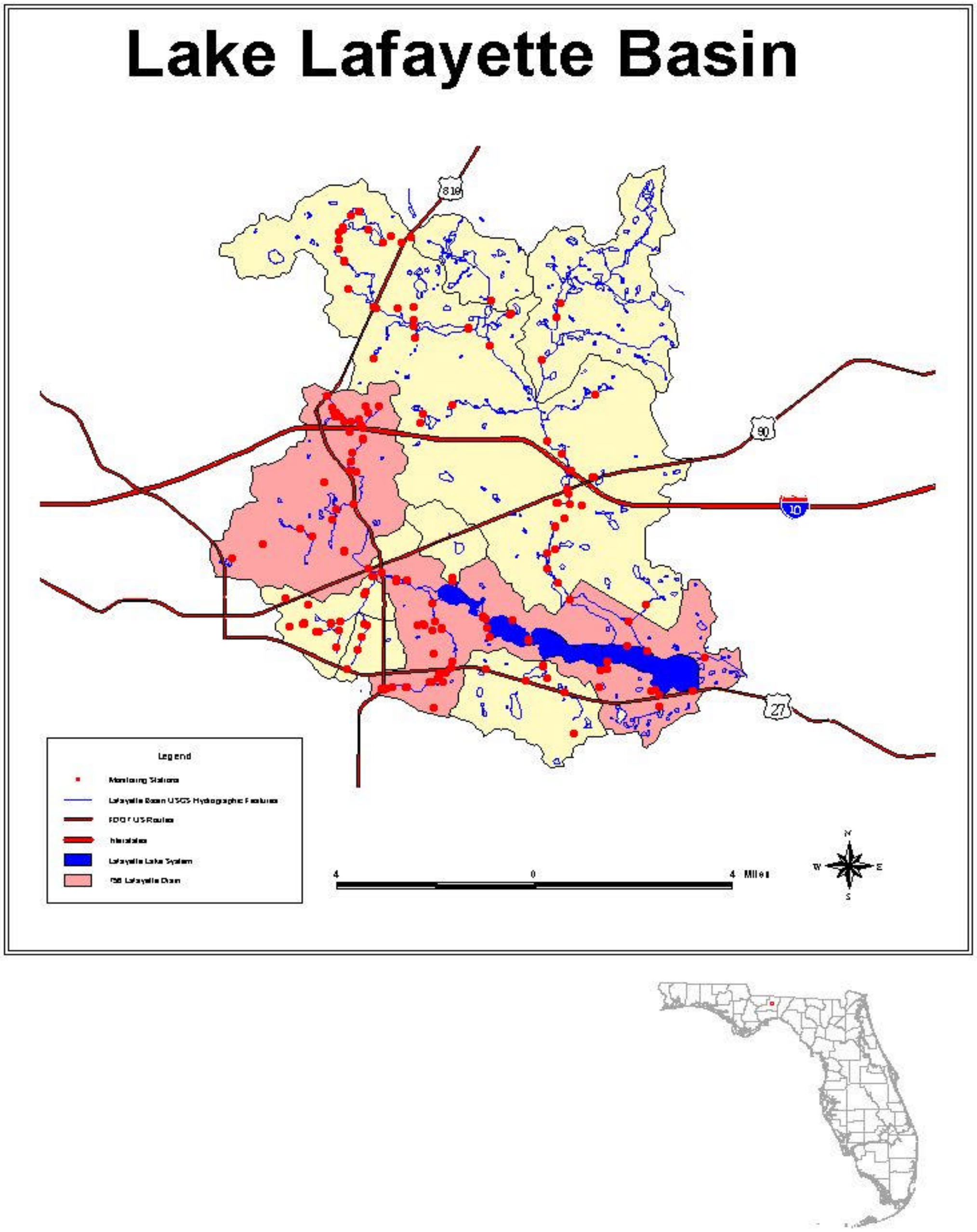

Figure 12. Northeast Drainage Ditch Location Map

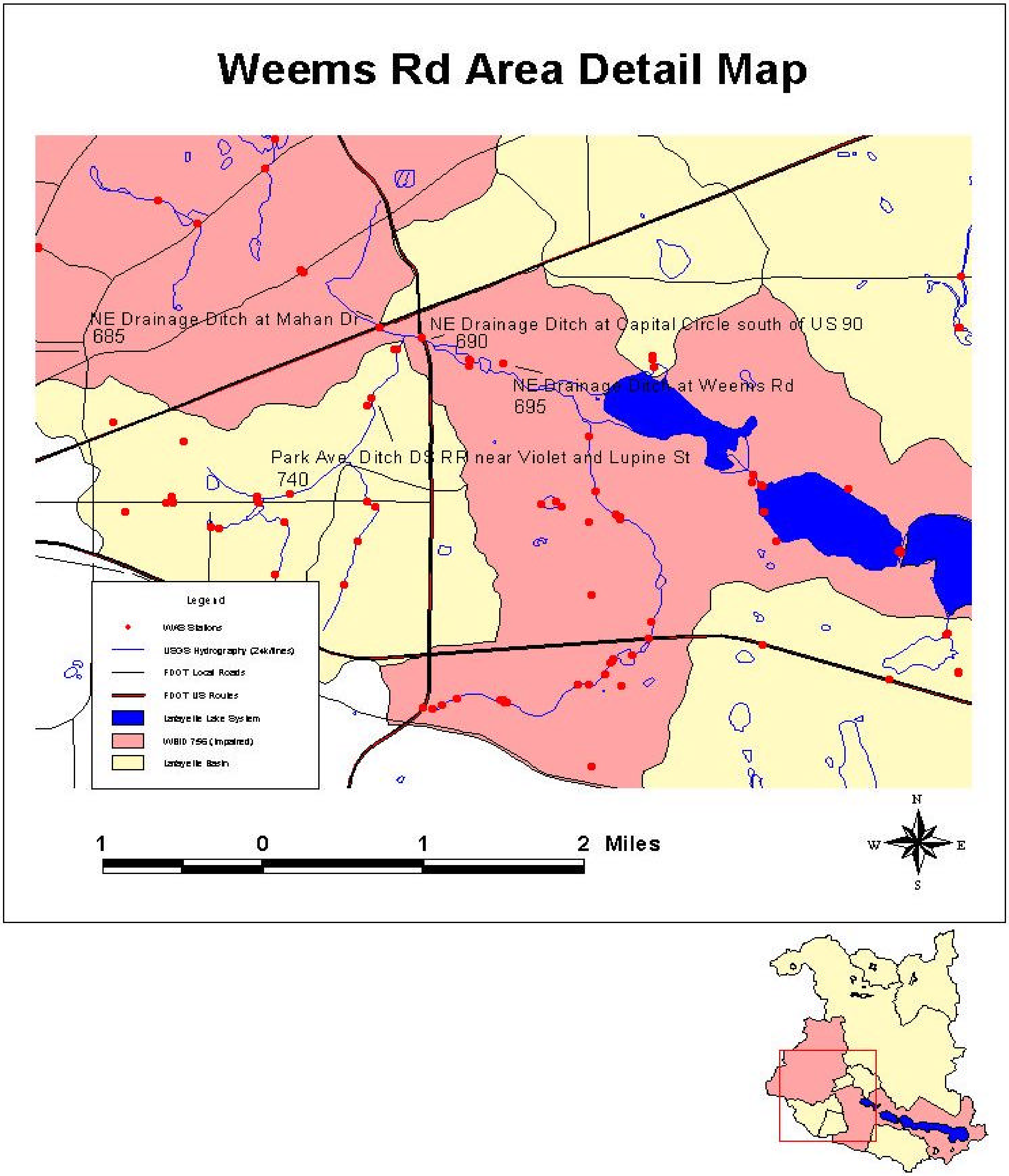

Figure 13. Northeast Drainage Ditch Sampling Locations

Appendix B – Reference Stream Data

Table 25 TN Reference Data Summary

Station_ID	Date and Time	PCode	TN (mg/L)	Medians
21FLA 22020049	07/08/1992 21:30	TN	0.327	
21FLA 22020049	03/25/1993 10:30	TN	0.32	
21FLA 22020049	03/25/1993 11:11	TN	0.32	
21FLA 22020049	07/20/1993 08:00	TN	0.329	
21FLA 22020049	03/21/1994 19:10	TN	0.312	
21FLA 22020049	08/01/1994 11:45	TN	0.623	
21FLA 22020049	02/13/1995 10:15	TN	0.847	
21FLA 22020049	02/13/1995 11:11	TN	0.85	
21FLA 22020049	07/09/1996 11:00	TN	0.394	
21FLA 22020049	07/09/1996 11:00	TN	0.394	0.3615
21FLA 22020062	08/01/1994 10:30	TN	0.493	
21FLA 22020062	02/13/1995 11:30	TN	0.744	
21FLA 22020062	07/19/1995 11:00	TN	0.328	
21FLA 22020062	02/13/1996 12:00	TN	0.245	
21FLA 22020062	08/12/1997 14:15	TN	0.664	0.493
21FLA 22030061	03/30/1993 10:00	TN	0.65	
21FLA 22030061	07/22/1993 11:30	TN	0.67	
21FLA 22030061	03/22/1994 11:00	TN	0.62	
21FLA 22030061	02/15/1995 11:11	TN	0.86	
21FLA 22030061	02/15/1995 14:15	TN	0.86	0.67
21FLA 31010050	07/08/1992 22:42	TN	0.392	
21FLA 31010050	03/25/1993 12:00	TN	0.37	
21FLA 31010050	07/20/1993 11:00	TN	0.38	
21FLA 31010050	03/21/1994 11:30	TN	0.339	
21FLA 31010050	08/01/1994 12:30	TN	0.334	
21FLA 31010050	02/13/1995 13:00	TN	0.398	

21FLA 31010050	07/09/1996 11:00	TN	0.426	
21FLA 31010050	07/09/1996 11:00	TN	0.426	0.426
21FLA 31010051	03/25/1993 11:11	TN	0.28	
21FLA 31010051	03/25/1993 19:15	TN	0.28	
21FLA 31010051	07/20/1993 21:30	TN	0.252	
21FLA 31010051	03/21/1994 10:40	TN	0.237	
21FLA 31010051	08/01/1994 13:30	TN	0.264	
21FLA 31010051	02/13/1995 18:00	TN	0.63	
21FLA 31010051	07/19/1995 22:45	TN	0.232	
21FLA 31010051	02/13/1996 08:00	TN	0.29	0.272
21FLA 31010140	08/01/1994 21:30	TN	0.96	
21FLA 31010140	02/13/1995 10:00	TN	2.21	
21FLA 31010140	07/10/1996 21:30	TN	1.27	
21FLA 31010140	07/10/1996 21:30	TN	1.27	1.27
21FLA 31010142	03/25/1993 14:00	TN	0.68	
21FLA 31010142	07/20/1993 12:30	TN	0.68	
21FLA 31010142	03/21/1994 12:30	TN	0.69	
21FLA 31010142	08/01/1994 10:15	TN	0.54	
21FLA 31010142	02/13/1995 11:30	TN	2.7	
21FLA 31010142	07/09/1996 11:00	TN	0.78	
21FLA 31010142	07/09/1996 11:00	TN	0.78	0.69
		75th =	0.717	0.68
			all	medians
		count =	47	7

Table 26 TP Reference Data Summary

Station_ID	Date and Time	PCode	Depth_M	RCode	Result	Medians
21FLA 22020049	07/08/1992 21:30	TP	0.98	T	0.025	
21FLA 22020049	03/25/1993 10:30	TP	0.5		0.024	
21FLA 22020049	03/25/1993 11:11	TP	0.5		0.024	
21FLA 22020049	07/20/1993 08:00	TP	0.5	T	0.014	
21FLA 22020049	03/21/1994 19:10	TP	1		0.027	
21FLA 22020049	08/01/1994 11:45	TP	0.5		0.036	
21FLA 22020049	02/13/1995 10:15	TP	0.5		0.049	
21FLA 22020049	02/13/1995 11:11	TP	0.5		0.049	
21FLA 22020049	07/09/1996 11:00	TP	1		0.037	
21FLA 22020049	07/09/1996 11:00	TP	0.5		0.037	0.0315
21FLA 22020062	08/01/1994 10:30	TP	0.5		0.013	
21FLA 22020062	02/13/1995 11:30	TP	0.5		0.041	
21FLA 22020062	07/19/1995 11:00	TP	0.5		0.012	
21FLA 22020062	02/13/1996 12:00	TP	1	U	0.004	
21FLA 22020062	08/12/1997 14:15	TP	0.3	I	0.018	0.013
21FLA 22030061	03/30/1993 10:00	TP	0.5		0.15	
21FLA 22030061	07/22/1993 11:30	TP	0.5		0.13	
21FLA 22030061	03/22/1994 11:00	TP	1		0.11	
21FLA 22030061	02/15/1995 11:11	TP	0.5		0.14	
21FLA 22030061	02/15/1995 14:15	TP	0.5		0.14	0.14
21FLA 31010050	07/08/1992 22:42	TP	0.66		0.2	
21FLA 31010050	03/25/1993 12:00	TP	0.5		0.16	
21FLA 31010050	07/20/1993 11:00	TP	0.5		0.18	
21FLA 31010050	03/21/1994 11:30	TP	1		0.13	
21FLA 31010050	08/01/1994 12:30	TP	0.98		0.15	
21FLA 31010050	02/13/1995 13:00	TP	0.5		0.16	

21FLA 31010050	07/09/1996 11:00	TP	0.5	A	0.21	
21FLA 31010050	07/09/1996 11:00	TP	1	A	0.21	0.17
21FLA 31010051	03/25/1993 11:11	TP	0.5		0.031	
21FLA 31010051	03/25/1993 19:15	TP	0.5		0.031	
21FLA 31010051	07/20/1993 21:30	TP	0.5	T	0.013	
21FLA 31010051	03/21/1994 10:40	TP	1		0.028	
21FLA 31010051	08/01/1994 13:30	TP	0.5		0.027	
21FLA 31010051	02/13/1995 18:00	TP	0.5		0.026	
21FLA 31010051	07/19/1995 22:45	TP	0.5		0.04	
21FLA 31010051	02/13/1996 08:00	TP	1		0.017	0.0275
21FLA 31010140	08/01/1994 21:30	TP	3.6		0.077	
21FLA 31010140	02/13/1995 10:00	TP	0.5		0.2	
21FLA 31010140	07/10/1996 21:30	TP	0.5		0.12	
21FLA 31010140	07/10/1996 21:30	TP	1		0.12	0.12
21FLA 31010142	03/25/1993 14:00	TP	0.5		0.13	
21FLA 31010142	07/20/1993 12:30	TP	0.5		0.17	
21FLA 31010142	03/21/1994 12:30	TP	1		0.15	
21FLA 31010142	08/01/1994 10:15	TP	1.64		0.13	
21FLA 31010142	02/13/1995 11:30	TP	0.5		0.87	
21FLA 31010142	07/09/1996 11:00	TP	0.5		0.22	
21FLA 31010142	07/09/1996 11:00	TP	1		0.22	0.17
				75th =	0.077	0.120
					all	medians
				count =	47	7

Table 27 Turbidity Reference Data Summary

Station_ID	Date and Time	PCode	Depth_M	RCode	Result	Medians
21FLA 22020049	07/08/1992 21:30	TURB	0.98		4.3	
21FLA 22020049	03/25/1993 10:30	TURB	0.5		31	
21FLA 22020049	03/25/1993 11:11	TURB	0.5		31	
21FLA 22020049	03/21/1994 19:10	TURB	1		2.4	
21FLA 22020049	08/01/1994 11:45	TURB	0.5		3.2	
21FLA 22020049	07/09/1996 11:00	TURB	1		3	
21FLA 22020049	07/09/1996 11:00	TURB	0.5		3	3.2
21FLA 22020062	08/01/1994 10:30	TURB	0.5		1.7	
21FLA 22020062	02/13/1996 12:00	TURB	1		1.4	
21FLA 22020062	08/12/1997 14:15	TURB	0.3		2.2	1.7
21FLA 22030061	03/30/1993 10:00	TURB	0.5		4.1	
21FLA 22030061	03/22/1994 11:00	TURB	1		4.5	4.3
21FLA 31010050	07/08/1992 22:42	TURB	0.66		11.3	
21FLA 31010050	03/25/1993 12:00	TURB	0.5		5.5	
21FLA 31010050	03/21/1994 11:30	TURB	1		8	
21FLA 31010050	08/01/1994 12:30	TURB	0.98	A	9	
21FLA 31010050	07/09/1996 11:00	TURB	0.5	A	9.9	
21FLA 31010050	07/09/1996 11:00	TURB	1	A	9.9	9.45
21FLA 31010051	03/25/1993 11:11	TURB	0.5		4.8	
21FLA 31010051	03/25/1993 19:15	TURB	0.5		4.8	
21FLA 31010051	03/21/1994 10:40	TURB	1		4.2	
21FLA 31010051	08/01/1994 13:30	TURB	0.5		5.6	
21FLA 31010051	02/13/1996 08:00	TURB	1		2.6	4.8
21FLA 31010140	06/02/1994 11:40	TURB	0.5		11	
21FLA 31010140	08/01/1994 21:30	TURB	3.6		38	
21FLA 31010140	07/10/1996 21:30	TURB	0.5		35	

21FLA 31010140	07/10/1996 21:30	TURB	1		35	35
21FLA 31010142	03/25/1993 14:00	TURB	0.5		10	
21FLA 31010142	03/21/1994 12:30	TURB	1		16	
21FLA 31010142	08/01/1994 10:15	TURB	1.64		17	
21FLA 31010142	07/09/1996 11:00	TURB	0.5		20	
21FLA 31010142	07/09/1996 11:00	TURB	1		20	17
				75th =	16.25	13.23
					all	medians
				count =	32	7

Table 28 BOD5 Reference Data Summary

Station_ID	Date and Time	PCode	Depth_M	RCode	Result	Median
21FLA 22020049	07/20/1993 08:00	BOD	0.5	U	0.2	
21FLA 22020049	02/13/1995 10:15	BOD	0.5		0.4	
21FLA 22020049	02/13/1995 11:11	BOD	0.5		0.4	0.4
21FLA 22030061	08/13/1992 11:11	BOD	0.5		0.2	
21FLA 22030061	08/13/1992 22:00	BOD	0.5		0.2	
21FLA 22030061	07/22/1993 11:30	BOD	0.5	U	0.2	
21FLA 22030061	02/15/1995 11:11	BOD	0.5		0.8	
21FLA 22030061	02/15/1995 14:15	BOD	0.5		0.8	0.2
21FLA 31010050	02/13/1995 13:00	BOD	0.5		0.3	0.3
21FLA 31010140	06/02/1994 11:40	BOD	0.5		1.1	1.1
21FLA 31010142	08/13/1992 13:00	BOD	0.5		0.3	0.3
				75th =	0.60	0.40
					all	medians
				count =	11	5

Appendix C – Northeast Drainage Ditch Load Curve Analysis

Data sources for WBID 756 included STORET, the FDEP WAS Access database, data obtained from consultants, the City of Tallahassee, Leon County, and FDEP permit files. Long-term water quality data are available at two stations, S690 and S695. Station S690 is located upstream of Weems Pond at US 319. Station S695 is downstream of Weems Pond at the intersection of Northeast Drainage Ditch and Weems Road (see Figure 13). Elevated coliform levels have been measured at both stations. Coliform loads are calculated at both stations, and the analysis resulting in the greatest percent reduction is selected for the TMDL. Statistical summaries of fecal and total coliforms are provided in

Table C- 2 and Table C- 3.

Table C- 1. Fecal Coliform (FC) and Total Coliform (TC) Collected in WBID 756

Date	Max FC (col/100mL) S 690	Max TC (col/100mL) S 690	Max FC (col/100mL) S 695	Max TC (col/100mL) S 695
12/2/96	3000	9000	5000	30000
12/9/96	170	2200	1700	13000
12/10/96	1700	13000	300	8000
12/16/96	5000	11000	20	500
12/17/96	2300	22000	40	300
2/13/97	24000	50000	13000	30000
2/14/97	8000	50000	5000	17000
2/20/97	170	1400	40	5000
2/21/97	2400	22000	230	3000
2/27/97	1100	8000	1300	17000
2/28/97	1700	5000	800	8000
4/28/97	13000	50000	30000	160000
4/29/97	5000	5000	2300	11000
5/5/97	5000	30000	40	300
5/6/97	130	1300	70	800
5/12/97	110	1100	40	80
5/13/97	170	2200	80	80

Date	Max FCS (col/100mL) 690	Max TCS (col/100mL) 690	Max FCS (col/100mL) 695	Max TCS (col/100mL) 695
8/11/97	8000	30000	30000	90000
8/12/97	1300	24000	14000	160000
8/18/97	5000	50000	80	30000
8/19/97	1300	24000	70	30000
8/25/97	500	3000	2	5000
8/26/97	170	5000	2	1700
12/1/97	5000	5000	8000	30000
12/2/97	400	1400	1700	13000
12/8/97	170	9000	220	800
12/9/97	2400	5000	40	500
12/15/97	1600	1600	900	1601
12/16/97	1600	1600	900	1600
2/3/98	1700	16000	3000	16000
2/4/98	1700	16000	3000	5000
2/10/98	110	800	20	80
2/11/98	500	5000	80	230
2/17/98	1600	1600	1600	1600
2/18/98	900	1600	1600	1600
6/1/98	1400	16000	2200	9000
6/2/98	1400	16000	9000	9000
6/9/98	130	1100	20	80
6/10/98	80	300	20	20
6/16/98	300	300	17	80
6/17/98	500	500	2	13
6/20/98	1600	1601		

Date	Max FC (col/100mL) S 690	Max TC (col/100mL) S 690	Max FC (col/100mL) S 695	Max TC (col/100mL) S 695
6/21/98	300	1601		
6/26/98	500	5000		
6/27/98	500	9000		
8/20/98			1600	1601
8/21/98			170	1601
8/26/98			80	2800
8/27/98			4	9000
9/8/98	220	2800	130	170
9/9/98	900	5000	50	300
11/16/98	9000	16001	230	3000
11/17/98	1300	16000	130	3000
11/24/98	130	1300	20	70
11/25/98	140	1700	20	110
12/2/98	240	1100	2	23
12/3/98	240	500	4	50
3/1/99	170	900	170	1400
3/2/99	240	1600	30	1600
3/8/99	900	2400	8	80
3/9/99	110	900	2	23
3/15/99	2400	16000	1700	9000
3/16/99	1600	2400	500	9000
6/7/99	500	16001	2	220
6/8/99	5000	16001	110	220
6/14/99	170	9000	30	900
6/15/99	5000	30000	50	2400

Date	Max FCS (col/100mL) 690	Max TCS (col/100mL) 690	Max FCS (col/100mL) 695	Max TCS (col/100mL) 695
6/21/99	280	3000	23	900
6/22/99	500	17000	1600	3000
9/2/99	130	16000	2	24000
9/3/99	300	1600	2	16000
9/9/99	30000	160001	30	2400
9/10/99	16000	90000	280	9000
9/16/99	500	5000	2	3000
9/17/99	240	5000	4	1600
11/1/99	50000	160000	2400	30000
11/2/99	30000	110000	50000	160000
11/8/99	300	5000	70	2400
11/9/99	220	16000	80	1700
11/15/99	50	3000	26	1600
11/16/99	240	5000	30	900
2/14/00	16000	160000	5000	240000
2/15/00	5000	160000	50000	240000
2/21/00	130	5000	22	500
2/22/00	140	24000	23	1600
2/28/00	240	3000	300	7000
2/29/00	300	5000	300	16000
4/24/00	30000	160001	70	9000
4/25/00	17000	160001	900	90000
5/1/00	800	2400	8	9000
5/2/00	70	5000	4	5000
5/11/00	30	5000	4	9000

Date	Max FCS (col/100mL) 690	Max TCS (col/100mL) 690	Max FCS (col/100mL) 695	Max TCS (col/100mL) 695
5/12/00	80	5000	4	3000
8/10/00	16000	50000	9000	50000
8/11/00	5000	24000	17000	90000
8/15/00	1400	16000	23	9000
8/16/00	2400	16000	80	5000
8/29/00	7000	30000	80	11000
8/30/00	5000	16000	500	9000
12/6/00	240	1600	4	13
12/7/00	300	900	7	130
3/8/01	110	2400		
3/9/01	70	2200	17	240
12/5/01	900	2400	4	7
12/6/01	2	1100		
12/12/01	500	5000	23	1700
12/13/01	500	3000	80	500
12/18/01	3000	30000	50	500
12/19/01	300	1700	50	240
1/14/02	9000	160000	1100	30000
1/15/02	5000	90000	900	2300
1/21/02	3000	50000	5000	160000
1/22/02	900	30000	2100	90000
1/28/02	900	9000	170	16000
1/29/02	210	2400	300	2400
8/20/02	2200	30000	3000	30000
8/21/02	500	9000	1600	9000

Date	Max FCS (col/100mL) 690	Max TCS (col/100mL) 690	Max FCS (col/100mL) 695	Max TCS (col/100mL) 695
8/27/02	50000	160001	11000	90000
8/28/02	11000	90000	9000	90000
9/4/02	5000	30000	240	1700
9/5/02	240	2400	170	1100

Table C- 2. Summary of Fecal Coliform Monitoring Data

WBID	Station	Total Number Samples	30-Day Geometric Mean	% Samples >400 counts/100mL	Minimum Concentration (counts/100mL)	Maximum Concentration (counts/100mL)
756	S690	123	NA	48	2	50000
756	S695	121	NA	27	2	50000

Note: NA = not available; insufficient number of samples collected in 30-day period to evaluate this criteria

Table C- 3. Summary of Total Coliform Monitoring Data

WBID	Station	Total Number Samples	30-Day Geometric Mean	% Samples > 2400 counts/100mL	Minimum Concentration (counts/100mL)	Maximum Concentration (counts/100mL)
756	S690	117	NA	68	300	160,000
756	S695	115	NA	51	7	240,000

Note: NA = not available; insufficient number of samples collected in 30-day period to evaluate this criteria

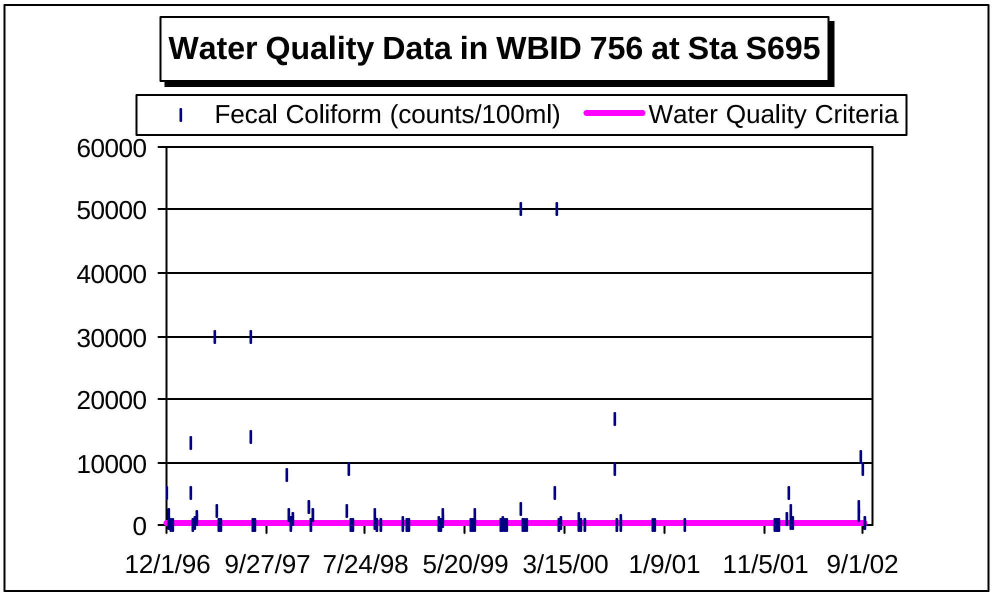

Figure C- 1. Fecal Coliform Measurements in Northeast Drainage Ditch at Station S695

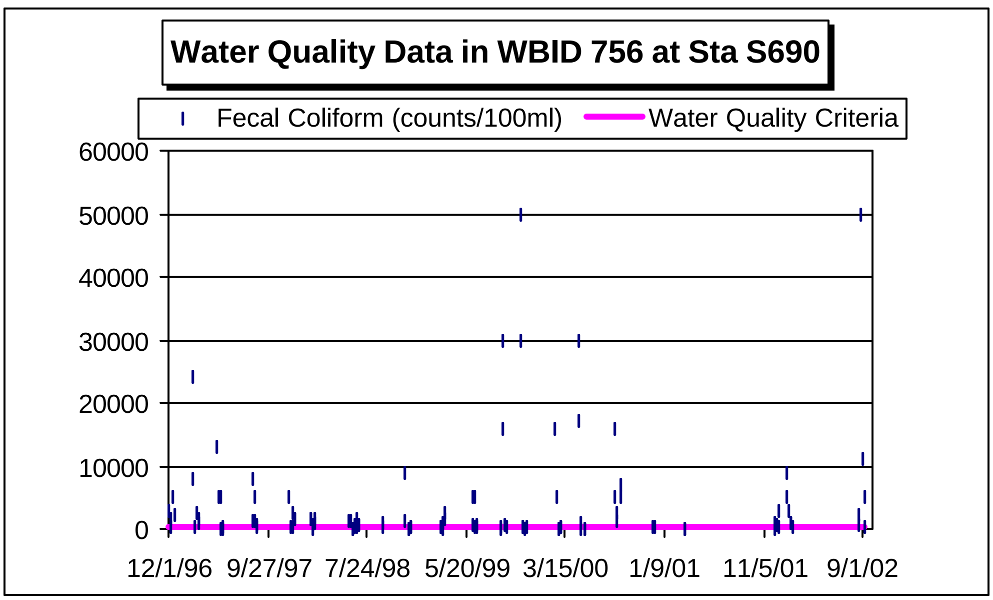

Figure C- 2. Fecal Coliform Measurements in Northeast Drainage Ditch at Station S690

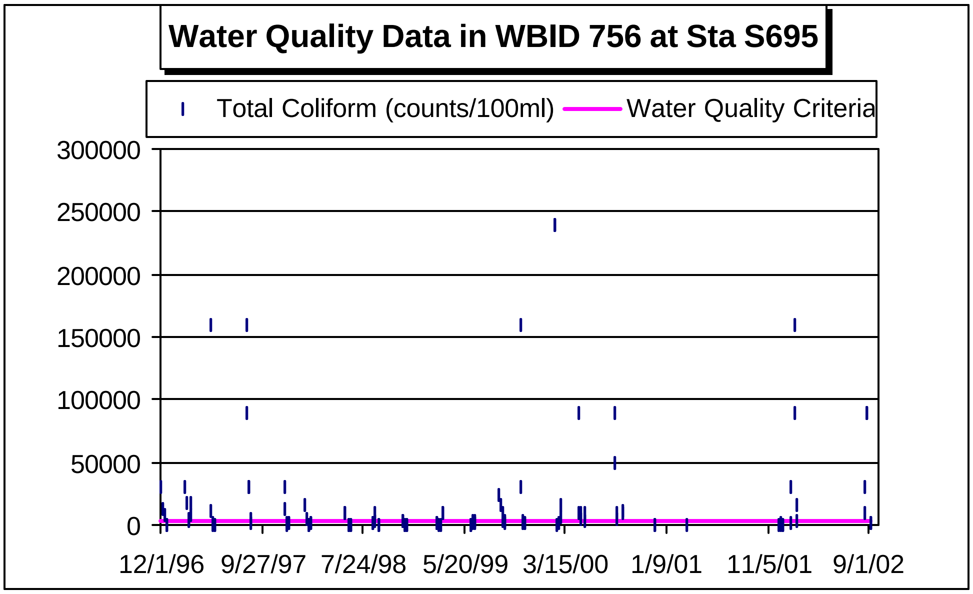

Figure C- 3. Total Coliform Measurements in Northeast Drainage Ditch at Station S695

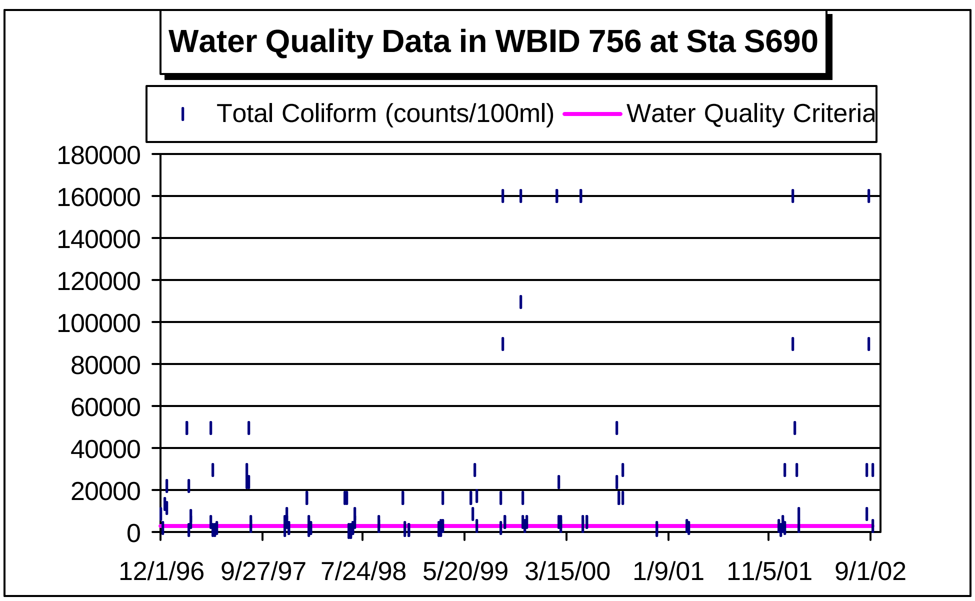

Figure C- 4. Total Coliform Measurements in Northeast Drainage Ditch at Station S690

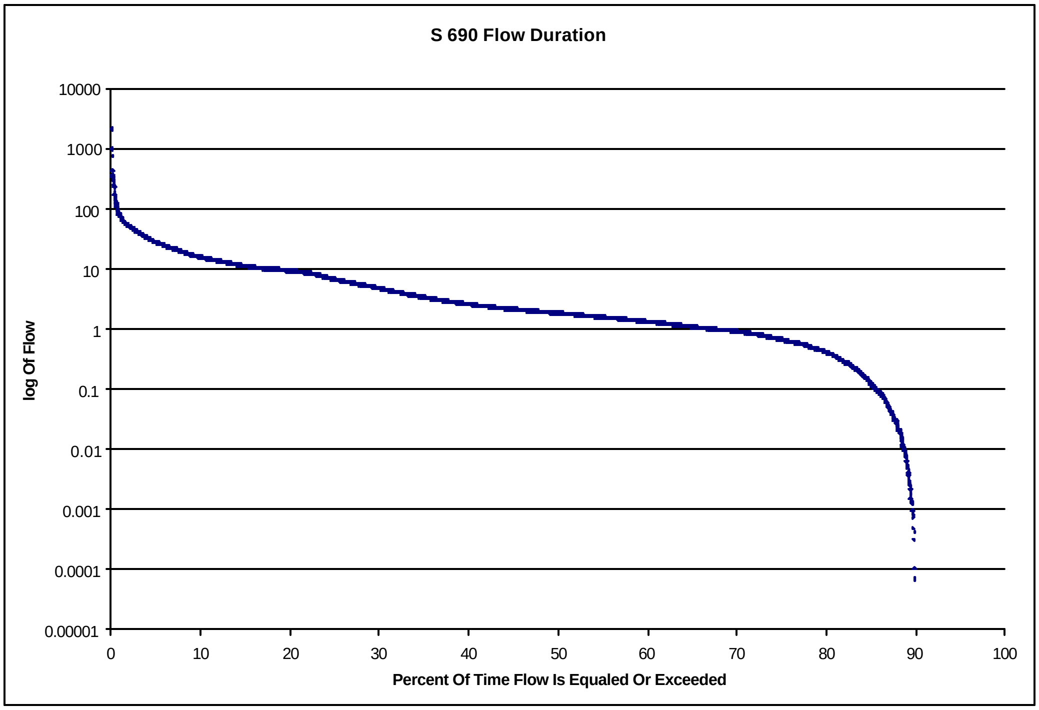

Figure C- 5. Flow Duration Curve for Northeast Drainage Ditch as Station S690

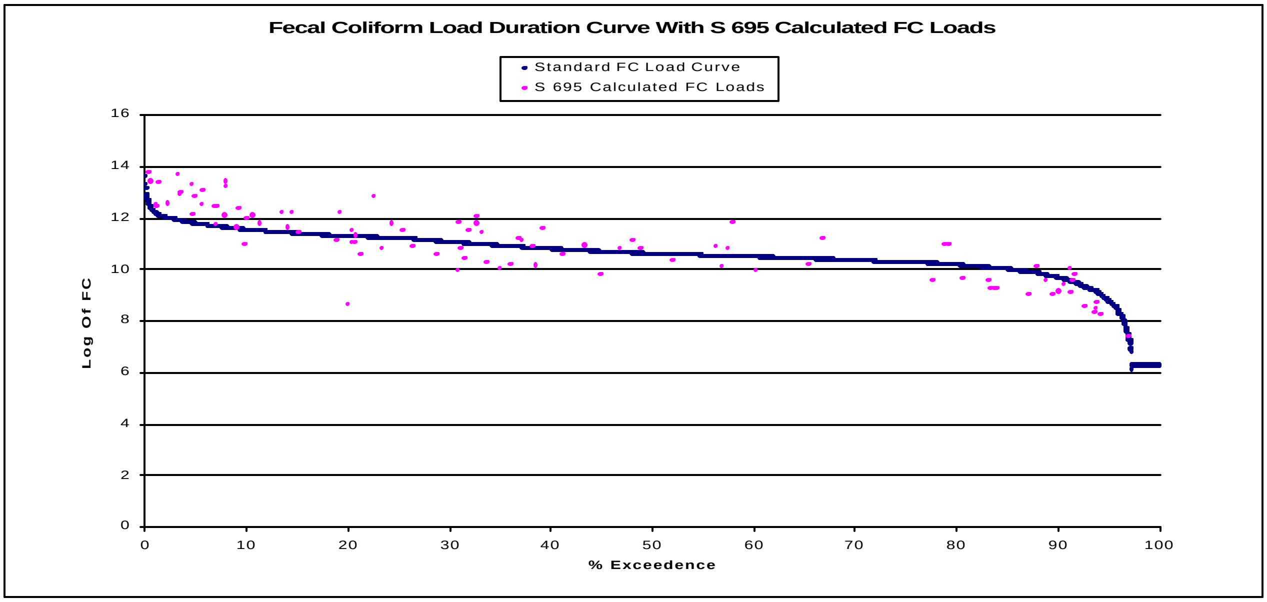

Figure C- 6. Fecal Coliform Load Duration Curve at Station S695

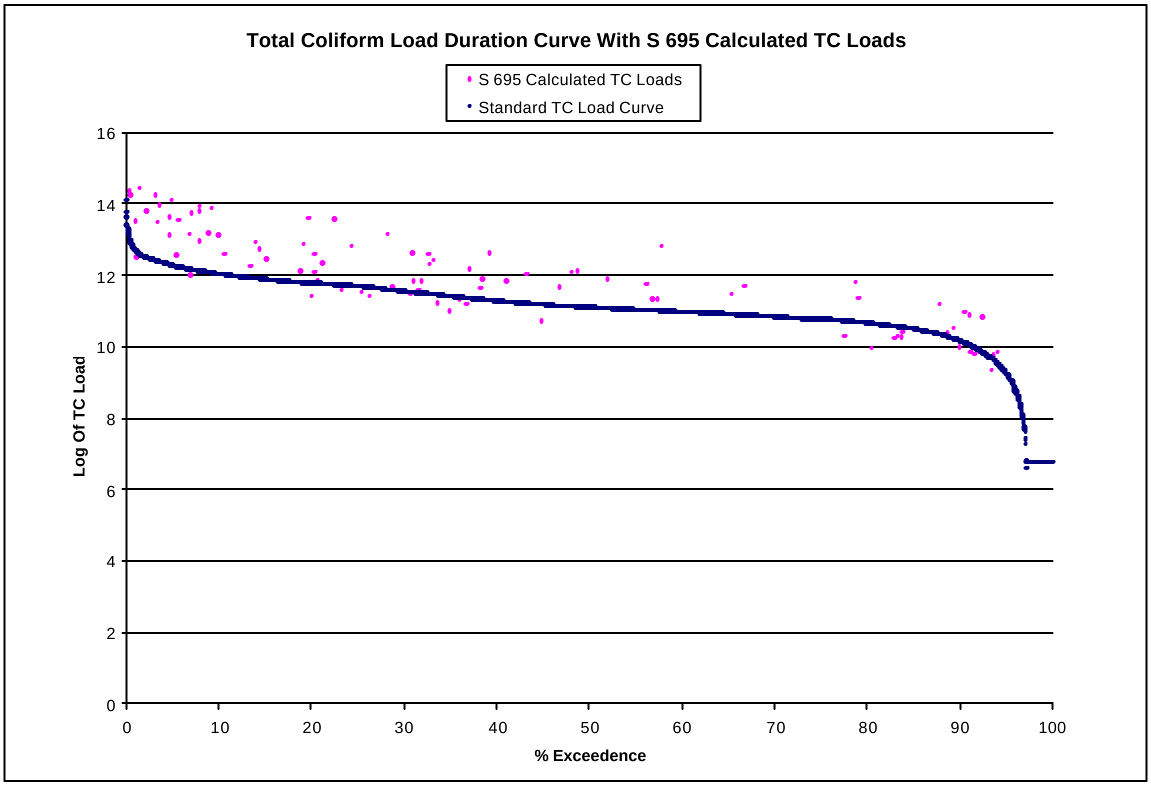

Figure C- 7. Total Coliform Load Duration Curve at Station S695

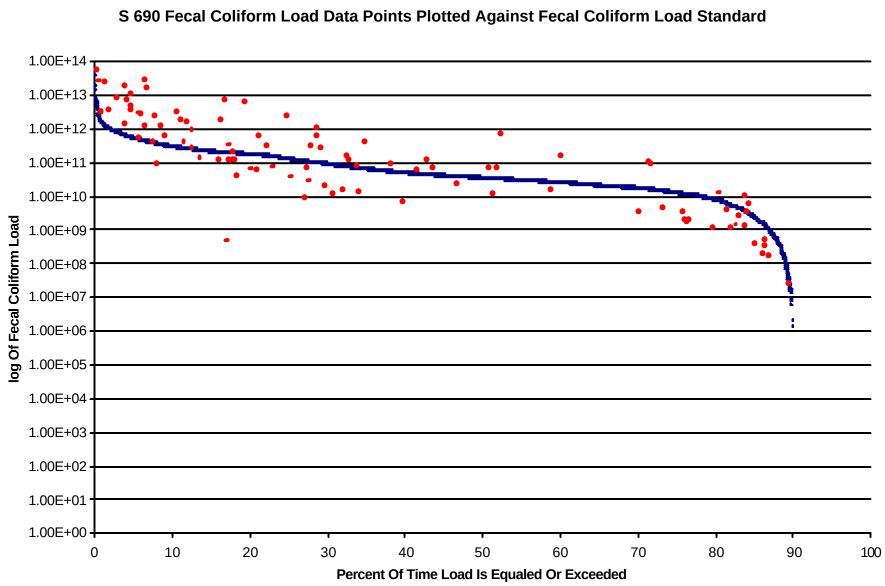

Figure C- 8. Fecal Coliform Load Duration Curve at Station S690

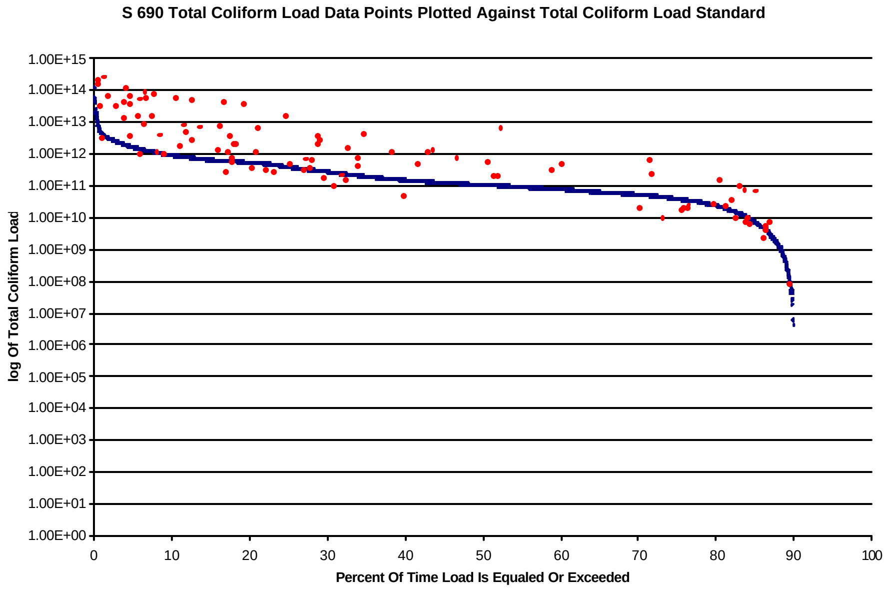

Figure C- 9. Total Coliform Load Duration Curve at Station S690

CHECK ON FECAL COLIFORM PERCENT REDUCTION IN NORTHEAST DRAINAGE DITCH BASED ON THE NOT TO EXCEED 400 CRITERIA (AT STATION S695)

10% samples can exceed 400 counts/100ml; therefore, highest remaining concentration is about: 5000 counts/100ml

Percent Reduction to 400 is: (5000-400)/5000 *100 = 92 percent

Appendix D – TMDL for Nutrients and DO in Upper Lake Lafayette (WBID 756A)

(Prepared by FDEP and available as a separate file on EPA's web site:
http://www.epa.gov/region4/water/tmdl/Florida)